John Todd Murphy, PhD, MA Ed.

Independent Researcher/Writer

Volunteer Affiliate, Northern Illinois University, Dept. of Anthropology

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Research Areas

- Computational Social Science and Agent-Based Modeling
- Modeling complex coupled human and natural systems & climate adaptation
- Complexity, self-organization, and resilient systems
- Theoretical and practical aspects of modeling in science
- Modeling for Policy, Environmental, and Energy Justice

Positions Held (Post Ph.D.)

Computational Engineer, Argonne National Lab *2012 - 2024*
Decision and Infrastructure Sciences Division

Computational Postdoctoral Fellow, Argonne National Lab *2010 - 2012*
Decision and Information Sciences/Leadership Computing Facility

Fellow, University of Chicago *2013 - 2024*
Computation Institute/CASE

Fellow, Northwestern University *2016 – 2024*
Northwestern-Argonne Institute for Science and Engineering

Research Associate Professor, Northern Illinois University *2019-2023*
Department of Anthropology

Honors Faculty Fellow/Instructor, Northern Illinois University *Fall 2021*

Instructor, Northern Illinois University *Summer 2020*
Department of Anthropology

Research Specialist, University of Illinois Chicago *2023- 2024*
Institute for Environmental Science and Policy

Education

PhD, Anthropology, University of Arizona *August 2009*
Dissertation committee: J. Stephen Lansing (chair), Steven L. Kuhn, Paul R. Fish, Suzanne K. Fish, and Mark S. Aldenderfer. Dissertation title: *Exploring Complexity in the Past: The Hohokam Water Management Simulation*.

Master of Arts, Anthropology, University of Arizona *May 2000*
Advisor: T. Patrick Culbert. Focus: Maya archaeology. MA Thesis title: *Approaching Maya Polities from the Side: Models of Classic Maya Political Organization*.

Bachelor of Arts, Anthropology, Ohio State University *August 1997*
Focus in Archaeology and Archaeological Theory. Degree granted *summa cum laude*.

Master of Arts in Education, Ohio State University *September 1993*
Advisor: Merry M. Merryfield. Specialization in Secondary Social Studies Education.

Bachelor of Arts, History, Ohio State University *June 1991*
Specialization in Ancient History; minor in History of Art. Degree granted *summa cum laude* with Honors in the Liberal Arts.

Projects and Roles

Researcher, PR100/Metrics of Energy Justice *Decision and Infrastructure Sciences*

Contributor to the PR100 project researching the transition to renewable energy on the island of Puerto Rico. Duties include literature review on energy justice, preparing for and participating in meetings with the stakeholder Advisory Group, leading discussions with small stakeholder groups, presenting in public-facing webinars, and organizing data for metrics analysis of transition scenarios.

Researcher, CIACC/NLP for Climate Change *Decision and Infrastructure Sciences*

Contributor to the Community and Infrastructure Adaptation to Climate Change (CIACC) Laboratory-Directed R&D effort to understand how natural language processing can help decision-makers prepare for climate change. Duties include applying NLP tools to strip references from IPCC reports, design of database to support NLP extraction from 76M records from Semantic Scholar database.

Researcher, CIRCULAR/ Circular Economy Transition *(PI: Tom Theis, UIC)*

Contributor to an NSF-funded $150K planning grant "SRS RN: Convergent Innovations in Regional Circular Economies" to investigate convergent research approaches to understand potential transitions to a (more) circular economy for the northern Illinois region.

Lead, Studio for Augmented Collaboration *Decision and Infrastructure Sciences*

Visualization laboratory for 3-D, Virtual-Reality, Augmented Reality, Machine Learning, and collaborative visualization technique for complex datasets, including supply chains, social conflicts, simulated and real-world infrastructure data.

PI, Sustainable Urban/Regional Modeling (SUReNet) *Northern Illinois University*

With Moira Zellner (Northeastern University) and Sybil Derrible (University of Illinois Chicago). Lead PI on $18K funded project from Illinois Innovation Network to research sustainable paths for Chicago and surrounding peri-urban and rural regions.

UCL: Fostering International Collaboration in Advanced Digital Research

With: Ting Sun, University College London. Focus is ccoupling Agent-Based Models with microclimate simulation in urban contexts. Funding received from UCL internal competition.

Researcher, NRMC/Risk Architecture *Decision and Infrastructure Sciences*

Contributor to an effort by the National Risk Management Center (Department of Homeland Security) to understand the interdependencies among the 55 National Critical Functions. Duties included exploring alternative strategies for charting relationships and generating visualizations to illustrate possible graph analyses.

Collaborator, CURES *(PI: Carolee Rigsbee, UIS)*

Center for Urban Resilience and Environmental Sustainability (CURES) organizes semi-annual workshops for small, underserved, rural communities to address infrastructure needs and sustainability issues, and focus on issues arising from rural-urban interactions.

Co-PI, SocialSim *DARPA/University of Central Florida (2018-2021)*

Lead developer of Repast HPC version of social simulation of online behavior and information spread on team software development sites and social media platforms.

Researcher, Foresight Initiative *National Geospatial Intelligence Agency*

Phase 1: Develop capacity for couple high-performance computing modeling including Integrated Assessment Model (GCAM, with Pacific Northwest National Laboratory), visualization and analysis (Decision Theater, Arizona State University), on Oak Ridge National Laboratory 'Titan' supercomputer. Role: Developer, coupling Repast social and economic models to existing models on new infrastructure.

Phase 2: Modeling infectious diseases. Role: Lead researcher for survey of state-of-the-art in disease modeling.

Researcher, Ebola Modeling *Argonne Laboratory-Directed Research*

Phase 1: Develop 'AidiViz' visualization tools for Repast HPC-based social and disease simulation in which 5M agents move hourly for 10-year time period.

Phase 2: Develop 'ReFACE', general toolkit for agent-based modeling of disease transmission and progression.

Co-PI, CNH: Forest Governance and Climate Change in Driving Native Insect Outbreaks *National Science Foundation (PI, with Chris Bone, University of Oregon)*

Develop Repast Simphony and Repast HPC versions of mountain pine beetle dispersal, to be linked with social models of forest management (especially fire). Role: PI, Lead developer.

Researcher, CNH: Understanding the Consequences of Water-Use Decisions in a Dynamic Environment *National Science Foundation (with L. Alessa, A. Kliskey, J. Ozik, M. Altaweel, and R. Lammers)*

Phase 1: Data mining of 100K+ newspaper articles from four regions in the U.S. Southwest; created special-purpose entity extraction routines to identify water management institutions, and use document co-location to identify networks of relationships among these institutions. Showed that historical development of urban areas resulted in different network structures. Role: Lead developer and analyst.

Phase 2: Developed model of household water consumption based on data from Tucson, Arizona. Simulated consumption affected by price shocks and communication of conservation norms, calibrated to data from 1992-2012 to explore how much impact actual pricing changes might have had on the decline in per capita usage during this period. Role: Lead developer and analyst.

Phase 3: Explore regional implications for water consumption. Link the agent-based model to the U New Hampshire 'Water Balance Model', a physical hydrological model. Develop simulation of interaction of water management institutions in which manager strategies can impact other managers' choices and create an evolving system over time, improving previous static models. Role: Lead developer and analyst.

Lead Developer, Repast HPC *Argonne Laboratory-Directed Research*

Lead developer (2010-2016) for Repast HPC, the high-performance computing version of Argonne's Repast agent-based modeling toolkit.. Added capability to mix multiple varieties of agent relationship while maintaining cross-process (parallelized) model synchronization. Demonstrated scaling capabilities up to 32K processes and 68 billion agents.

Modeling Strategic Contexts *with David Sallach, Argonne*

Developer on vmStrat, a modeling toolkit for simulation of social conflict in strategic contexts. Allows agent relationships to be specified in multiple ways and permits analysts to investigate the pressures on each agent given that agent's perceptions of the positions of the other agents in strategic space. Role: Lead software developer.

Bone Tissue Modeling *with Elif Seyma Bayrak*

Worked with students from Illinois Institute of Technology on Repast HPC version of model of bone angiogenesis, including parallelization in 3-D space and generalized chemical diffusion algorithms. Role: Lead software developer.

Modeling Transformational Growth in Urban Settings *with Thomas Park and Mark Altaweel*

Linking a micro-scale agent-based model with macro-scale economic variables based on Transformational Growth Matrices (Edward Nell). Role: PI, Developer.

The Hohokam Water Management Simulation (Doctoral and Postdoctoral Research)

The HWM is a simulation of water management along the Salt and Gila Rivers, modeling conditions from 200 CE to 1400CE, and includes streamflow reconstructions, canal flow physics, a crop growth model, and agent-based models of canal and field management. Recent work with a trained water management specialist (M. Ertsen) and a geoarchaeologist (L. Purdue) has examined how the small-scale structure of the Hohokam canal reflects constraints on social arrangements and cooperative management.

Pre-2010

"Simulated Agents In Lisp" (SAIL) *with J. Stephen Lansing and Chris Langton, Santa Fe Institute*

Simulation of agent marriage and reproduction according to structured marriage and kinship rules. Simulation permitted marriage rules by arbitrary group (section system) or by kinship (e.g. mother's brother's daughter or any other arbitrary kinship link). Tested the rate of change of relatedness in structured populations for comparison with genetic data collected from Balinese villages. Role: Code developer.

Evolution of Cooperation *with John W. Pepper, University of Arizona*

Simulation of cooperator-defector dynamics in which both C and D agents preferentially avoid defectors. Showed that even if rule is constant (both types follow identical rule) population assortment (cooperators more consistently near other cooperators) can occur. Role: Code developer.

Masting Synchrony of Borneo Forests *with Lisa Curran, Yale University*

Simulation of forest dynamics in Borneo, in which trees use synchronized masting coordinated with El Niño to avoid predation by pigs. Specific interest was in spatial distribution and the impacts of disruption of spatial arrangement of forest on long-term dynamics. Role: Code developer.

PlayMate *with William Griffin, Arizona State University*

Reimplemented Python code into Repast and Repast Simphony. PlayMate simulated child interactions on a playground, testing the assumption that selection of play pairs would maximize stimulation and learning as individuals sought novel partners. Role: Code developer.

Primate Anatomical Database *with Mary Ellen Morbeck, University of Arizona*

Created a unified database of primate anatomical measurements from multiple varied collections, including living and dead specimens, spanning 20+ years. Allowed cross-species comparison of physical characteristics associated with life histories and behavioral strategies. Role: Database designer.

Publications

Murphy, John T.

In prep Institutional resistance and functional failure: Challenges of implementing policy change. Chapter to appear in *Bridging History and Policy*, Haldon, John, Mordechai, Lee, Fernandes, Ricardo, and Izdebski, Adam, eds.

Mallick, Tanwi, **Murphy, John**, Bergerson, Joshua David, Verner, Duane R. Verner, Hutchison, John K, and Levy, Leslie-Anne

2024 Analyzing Regional Impacts of Climate Change using Natural Language Processing Techniques. https://doi.org/10.48550/arXiv.2401.06817

Rozhkov, Anton, Zellner, Moira, **Murphy, John T.**, and Massey, Dean,

2025 Identifying leverage points for sustainable transitions in urban – rural systems: Application of graph theory to participatory causal loop diagramming. *Environmental Science and Policy,* 164103996. https://doi.org/10.1016/j.envsci.2025.103996

Zellner, Moira, Massey, Dean, Rozhkov, Anton, and **Murphy, John T.**

2023 Exploring the Barriers to and Potential for Sustainable Transitions in Urban–Rural Systems through Participatory Causal Loop Diagramming of the Food–Energy–Water Nexus. *Land* 2023, 12(3), 551; https://doi.org/10.3390/land12030551

Murphy, John T., and Crumley, Carole L., *with Carrie Hritz, Christian Isendahl, Lisa J. Lucero, John Meunier, Steffen Nijhuis, Payam Ostovar, Clemens Reichel, Vernon L. Scarborough, Federica Sulas, and T. L. Thurston*

2022 *If the past teaches, what does the future learn? Ancient Urban Regions and the Durable Future*. Research in Urbanism Series, Delft School of Architecture. TU Delft OPEN publishing, https://bookrxiv.com/index.php/b/catalog/book/32 .

Murphy, John T., Altaweel, Mark, Ozik, Jonathan, Lammers, Richard

2019 Understanding Institutions for Water Allocation and Exchange: Insights from Dynamic Agent-Based Modeling. *WIRES Water, 6(6):e1384.* *https://doi.org/10.1002/wat2.1384*

Nelson, Michael France, **Murphy, John T.** , Bone, Christopher and Altaweel, Mark

2018 "Cyclic Epidemics, Population Crashes, and Irregular Eruptions in Simulated Populations of the Mountain Pine Beetle, Dendroctonus Ponderosae." Ecological Complexity 36:218–29.

Murphy, John T.

2017 "Complexity Theory." In Oxford Bibliographies in Ecology. Ed. David Gibson. New York: Oxford University Press.

Murphy, John T., Bayrak, Elif Seyma, Ozturk, Mustafa Cagdas, Cinar, Ali

2016 "Simulating 3-D Bone Tissue Growth Using Repast HPC: Initial Simulation Design and Performance Results." *Proceedings of the 2016 Winter Simulation Conference*, T. M. K. Roeder, P. I. Frazier, R. Szechtman, E. Zhou, T. Huschka, and S. E. Chick, eds., pp. 2087-2098.

Murphy, John T., Ozik, Jonathan, Collier, Nicholson T., Altaweel, Mark, Lammers, Richard B., Prusevich, Alex, Kliskey, Andrew, and Alessa, Lilian

2015 "Simulating Regional Hydrology and Water Management: An Integrated Agent-Based Approach." *Proceedings of the 2015 Winter Simulation Conference*, L. Yilmaz, W K. V. Chan, I Moon, T M K. Roeder, C. Macal, and M D. Rossetti, eds., pp. 3913-3924.

Murphy, John T., Altaweel, Mark, Ozik, Jonathan, Lammers, Richard B., Collier, Nicholson T., Alessa, Lilian, Kliskey, Andrew, Williams, Paula, and Cason, Drew

2014 "Characterizing Relationships among Water Management Institutions Using Natural Language Processing: Four Case Studies from the U.S. Southwest." *Water*. 6(6):1601-1641. doi:10.3390/w6061601.

Ertsen, Maurits, **Murphy, John T.**, Purdue, Louise, Zhu, Tianduowa

2014 "A Journey of a Thousand Miles Begins with One Small Step: Human agency, hydrological processes and time in socio-hydrology." *Hydrology and Earth System Sciences*, 18:1369-3182. doi:10.5194/hess-18-1369-2014.

Ozik, Jonathan, Collier, Nicholson T., **Murphy, John T.**, Altaweel, Mark, Lammers, Richard B., Prusevich, Alex A., Kliskey, Andrew, and Alessa, Lilian

2014 "Simulating Water, Individuals, and Management." *Proceedings of the 2014 Winter Simulation Conference*, A. Tolk, S. Y. Diallo, I. O. Ryzhov, L. Yilmaz, S. Buckley, and J. A. Miller, eds., pp. 1120-1131.

Murphy, John T.

2012 “Exploring Complexity with the Hohokam Water Management Simulation: A Middle Way for Archaeological Modeling” *Ecological Modelling*. 241: 15-29.

Bezanson, Michelle F., Garber, Paul A., **Murphy, John T.**, and Premo, Luke S.

2008 “Patterns of subgrouping and spatial affiliation in a community of mantled howling monkeys” (*Alouatta palliata*). American Journal of Primatology 70 (3), pp. 282-293

Conference Presentations and Posters

Atwal, Kuldip Singh, **Murphy, John T.,** and Garibay, Ivan

2021 “Empirical Analysis of Aging Effects on Preferential Attachment with a Massive Twitter Dataset.” *IEEE Global Communications Conference (GLOBECOM)*, December 2021.

Murphy, John T

2019 “Is now a good time? Bridging Past and Present with Models and Modeling”. Computer Applications in Archaeology Conference (CAA) 2019, Krakow, Poland, April 2019.

Murphy, John T., Gunn, Joel, Ertsen, Maurits W., Kaplan, J., Cornell, S., Crumley, C., and Scarborough, V.

2018 “Human Beings and Planet Earth in Deep Time: New Challenges for Modelling The Long-Term Evolution of the Global Human-Earth System”. Conference on Complex Systems, Thessaloniki, Greece, September 2018.

Macal, Charles M., Ozik, Jonathan, Collier, Nicholson T., Tatara, Eric R., **Murphy, John T.**

2018 “chiSIM: An Agent-Based Simulation Model of Social Interactions in a Large Urban Area.” To be presented at the Winter Simulation Conference, Stockholm Sweden, December 2018.

Murphy, John T.

2016 “Global Modeling and Cities.” Paper presented at the Conference on Complex Systems, Amsterdam, The Netherlands, September 2016.

Murphy, John T., Ozik, Jonathan, Collier, Nicholson T., and Macal, Charles

2016 “Contagion Modeling with the chiSIM and ReFACE Frameworks: Agent-Based Models of Disease Transmission in Chicago, USA.” Paper presented at the Conference on Complex Systems, Amsterdam, The Netherlands, September 2016.

Murphy, John T.

2016 “Bidirectional Coupling of Earth System Models with Social Science Models: New Motivations and a Proposed Path.” Presentation given to the Community Earth System Model Social Dynamics Working Group Winter Workshop, Boulder, CO, February 2016.

Murphy, John T., Purdue, Louise, and Ertsen, Maurits W.

2015 "Combining Geoarchaeology and Simulation: A Novel Approach to Understanding Water Management in Prehistoric Settlements in Central and Southern Arizona, USA." Paper presented (by L. P.) at *Water History*, Delft, The Netherlands, June 2015.

Murphy, John T., Purdue, Louise, and Ertsen, Maurits W.

2015 "Changing Channels: Simulating Irrigation Management on Evolving Canal Systems for the Prehistoric Hohokam of Central Arizona." Paper presented in organized session, "Simulating Social Complexity to Understand the Archaeological Past," at the Society for American Archaeology Annual Meeting, San Francisco, CA, April 2015.

Park, Byung, Allen, Melissa, White, Devin, Weber, Eric M., **Murphy, John T.**, North, Michael, Sydelko, Pamela

2015 "MIRAGE: A Framework for Data-Driven Collaborative High-Resolution Simulation." Proceedings of the 13th International Conference on GeoComputation., pp. 343-348.

North, M., **Murphy, J.**, Sydelko, P., Martinez-Montoya, I., Sallach, D., and Macal., C.

2015 "Integrated Modeling of Conflict and Energy." Presented at the Winter Simulation Conference, Huntington Beach, CA., December 2015.

Murphy, John T.

2015 "Life Cycles of Scientific Simulation Models: From Transparency and Reproducibiliy to Longevity and Theory." Paper presented in organized session, Computational Transparency in Modeling Complex Systems," Conference on Complex Systems, Tempe, Arizona, September 2015.

North, M., **Murphy, J.**, Sydelko, P., Martinez-Montoya, I., Sallach, D., and Macal., C.

2015 "Complex Systems Modeling of Geopolitical Conflict and Energy to Support Global Security." Presented at the Conference on Complex Systems, Tempe, Arizona, September 2015.

Murphy, John T., Altaweel, Mark, Cisneros, Luis, and Park, Thomas K.,

2015 "Modeling Transformational Growth in Large African Cities." Poster given at the Conference on Complex Systems, Tempe, Arizona, September 2015.

Murphy, John T., Lammers, Richard B., Prusevich, Alex, Ozik, Jonathan, Altaweel, Mark, Collier, Nicholson T., Kliskey, Andrew, and Alessa, Lilian

2015 "Results and Lessons Learned from a Coupled Social and Physical Hydrology Model: Testing Alternative Water Management Policies and Institutional Structures Using Agent-Based Modeling and Regional Hydrology." Poster presented at the American Geophysical Union Meetings, San Francisco, CA, December 2015.

Murphy, John T., Lammers, Richard B., Prusevich, Alex, Ozik, Jonathan, Altaweel, Mark, Collier, Nicholson T., Kliskey, Andrew, and Alessa, Lilian

2014 "Modeling feedbacks between individual human decisions and hydrology using interconnected physical and social models." Poster presented at the American Geophysical Union Meetings, San Francisco, CA, December 2014.

Murphy, John T.

2014 "Resilience in a Wider Sense: How Archaeology Might Benefit from and Contribute to New Approaches to 'Resilient' Systems." Paper resented at the Society for American Archaeology Annual Meeting, Austin, TX, April 2014.

Murphy, John T., Altaweel, Mark, Alessa, Lilian, and Kliskey, Andrew

2013 "Water then and Water Now: Computational Approaches to Modeling Archaeological and Contemporary Water Management." Paper presented in organized session, "New Directions in Modeling Dynamics for Coupled Social-Natural Systems," at the Society for American Archaeology Annual Meeting, Honolulu, HI, April 2013.

Ertsen, Maurits W., and **Murphy, John T.**

2013 "Gone Water Does Mill Again: Modelling Irrigation at the Archaeological Site of Las Capas, Arizona (ASU)." Paper presented at the 9th Conference of the European Social Simulation Association, Warsaw, Poland, September 2013.

Murphy, John T.

2013 "Ball-and-Basin: Model, Metaphor, or just Misleading?" and "Agent-Based Models as Scenario Generation Tools." Presentations given at the Military Operations Research Society (MORS) Resilience Workshop, Argonne National Laboratory, Chicago, Illinois, September 11-12, 2013.

Ozik, Jonathan, Collier, Nicholson T., **Murphy, John T.**, and North, Michael J.

2013 "The ReLogo Agent-based Modeling Language." Paper presented at the Winter Simulation Conference, Washington, D.C., December 2013.

Murphy, John T., Ozik, Jonathan, Altaweel, Mark, Lammers, Richard B., Collier, Nicholson T., Kliskey, Andrew, Alessa, Lilian, Williams, Paula, and Cason, Drew

2013 "Using Data Mining and Natural Language Processing to Reveal Institutional Water Management Structures in Four Urban Areas in the US Southwest." Poster presented at the American Geophysical Union Fall Meeting, San Francisco, CA, December 2013.

Murphy, John T.

2013 "Large-Scale Irrigation on the Salt and Gila Rivers, ca 400-1400 CE: The Hohokam Water Management Simulation (Phase II) Summary of Results." Paper presented at the Society for American Archaeology Annual Meeting, Memphis, TN., April 2012.

Murphy, John T.

2013 “Repast HPC: An Agent-Based Modeling Toolkit for High-Performance Computing Platforms.” Presentation given at “Towards Large Multiscale Simulations of Complex Socio-Economic Systems with Heterogeneous Interacting Agents,” Nanyang Technological University, Singapore, November 2013.

Murphy, John T.

2012 “ABCM-HPC: A Framework for Archaeological Simulation in a High-Performance Computing Environment.” Presentation given at the Computers and Quantitative Applications in Archaeology Conference, Southampton, UK, 2012.

Murphy, John T.

2011 “Models, Modeling and Simulation in Anthropology and Archaeology: Traces of Technology, Legacies of Logic.” Presentation American Anthropological Association Annual Meeting, November 2011, Montreal QC.

Murphy, John T.

2011 “Computational Social Science and High Performance Computing: A Case Study of a Simple Model at Large Scales.” Computational Social Science Society of the Americas Annual Meeting, October 2011, Santa Fe, NM. (Conference Proceedings Available at http://computationalsocialscience.org; free registration/login required).

Murphy, John T.

2011 “Using a supercomputer to explore an archaeological complex system: The (new) Hohokam Water Management Simulation.” Poster, Society for American Archaeology Annual Meeting, April 2011, Sacramento, CA.

Murphy, John T.

2011 “Modeling the Resilience of an Archaeological Irrigation System: Challenges of Scope and Scale.” Presentation given at 'Resilience 2011,' March 2011, Tempe, AZ.

Murphy, John T. and Shutters, Shade T.

2010 “Network Attributes and the Emergence of Cooperative Behavior in Networked Populations.” Presentation given at Computational Social Science Society Annual Meeting, November 2010, Tempe, AZ

Murphy, John T.

2006 "The Hohokam Water Management Simulation." Computer Simulation Session Presentation, Archaeological Sciences of the Americas Conference, Tucson, Arizona, September 2006

Murphy, John T.

2006 "The Hohokam Water Management Simulation: A Collaborative Model for Exploring Alternative Pasts." Computer Applications in Archaeology 2006 Conference (CAA2006), Fargo, North Dakota, April 2006.

Murphy, John T.

2006 "Relational Database Theory and Archaeology: Practical and Theoretical Synergies." Computer Applications in Archaeology 2006 Conference (CAA2006), Fargo, North Dakota, April 2006.

Pavao-Zuckerman, Barnet, Chamblee, John F., Karl, Rick J., **Murphy, John T.**, Xia, Zhongxiang, Lange, Richard C., and Adams, E. Charles

2006 "Enforcing the Taxonomic Hierarchy with Relational Database Models: A Case Study from Arizona (U.S.)." Poster presented at the International Council for Archaeozoology, Mexico City, Mexico, August 2006.

Murphy, John T., and Kinzig, Ann P.

2006 "The Hohokam Water Management Simulation: Collaborative Modeling of a Complex Coupled Human/Environmental System." Poster presented at the CAP/LTER Poster Symposium, Global Institute for Sustainability, Arizona State University, January 19th 2006.

Murphy, John T., and Kinzig, Ann P.

2006 "The Hohokam Water Management Simulation: A Modeling Philosophy and its Advantages." Society for American Archaeology National Conference, San Juan, Puerto Rico, April 2006.

Murphy, John T.

2005 "Some Thoughts on The Hohokam Water Management Simulation and Next Generation Models." Presentation given to the Next Generation Simulations of Human-Environmental Interactions Working Group, Santa Fe Institute, University of Arizona & Arizona State University, December 12-14, 2005, Tucson, Arizona.

Murphy, John T.

2002 "Potential Contributions of Relational Database Theory to Archaeological Theory and Practice." Paper presented at the Society for American Archaeology National Conference, Denver, CO.

Sagebiel, Kerry L., and **Murphy, John T.**

2002 "A reanalysis of the use of space in Early Classic Maya tombs using Relational Database Theory." Paper presented at the Society for American Archaeology National Conference, Denver, CO.

Smith, Monica L., and **Murphy, John T.**

2001 "Urban Dynamics and Social Space: Recent Research at Sisupalgarh, India." Paper presented at the Society for American Archaeology National Conference, New Orleans, LA.

Grazioso, Liwy, Culbert, T. Patrick, Fialko, Vilma, Sever, Thomas, **Murphy, John**, and Ramos, Carmen

2000 "Arqueología en el Bajo La Justa, Petén, Guatemala." Paper presented at the Symposium for Guatemalan Archaeology, Guatemala City, July 2000.

Murphy, John T. and Richard W. Yerkes

1998 "Exploring the relationship between site size and population: a test case from central Cyprus." Paper presented at the Society for American Archaeology 63rd National Conference, Seattle.

Proposals Submitted [Unfunded]

NSF: SRS-RN: Convergent Innovations in Regional Circular Economies (CIRCULAR)

With: Tom Theis, University of Illinois Chicago (lead); Don Fullerton, University of Illinois; Weslynne Ashton, Illinois Institute of Technology;

Focus: 5-Year project to establish a research network of academics, policy leaders, NGOs, and community organizations to apply convergent research to furthering pathways to circularity in the Chicago/Northern Illinois rural-urban region. [Not selected; NSF project halted 2025]

NSF: DISES: Cross-scale coupling of Indigenous land use, wildland fires, and forest resilience

With: Christopher Roos (Southern Methodist University), lead

Focus: Bidirectional coupled modeling of dynamics of fire, resource exploitation, and landscape modifications among prehistoric native populations of New Mexico.

NSF/ERSC: Infrastructural Flows: exchanging social and material knowledges to develop new thinking, policies and practices for sustainable infrastructure

With: Veronica Strang (Durham University), lead

Focus: Working with anthropologists and engineers in four related water-management contexts to develop a formal toolkit (conceptual and software) for expressing the embodiment of cultural values in material infrastructure from across the disciplines.

NSF: CNH-L: Rising Conflicts over Water in the Eastern United States: Managing Water Supply at the Intersection of Natural and Human Systems

With: Richard C. Lammers (University of New Hampshire), Lead

Focus: Understand the ways that the structure of the legal system for adjudicating water disputes in the eastern U.S. will respond to anticipated challenges in the 21st century via legal analysis and agent-based modeling of four river basins with contrasting legal and biophysical challenges.

MoDERN CITY 2020: Modeling Earth's Resource Network for the City in the Year 2020

Belmont Forum- Sustainable Urban Growth Initiative

With: John T. Murphy (lead), Richard Sluizas, Franz Coenen, Gary Polhill, Jiaqi Ge, Moira Zellner, Allison Heppenstall, Andrew Wallett, Andrew White, Leilah Lyons, Rachel Havrelock, Nina Schwarz

Focus: Develop a general agent-based model of urban energy-water-nexus dynamics, based on three field cases in Asia, the U.S. and the U.K, and integrated these via a global network system simulation.

Flexible Nexus Modeling of food-energy-water interactions to untangle complexity, acknowledged incertitude and identify tradeoffs in Argentine agriculture systems (2016)

NSF: Innovations at the Nexus of Food, Energy, and Water Systems

With: Guillermo Podesta (lead), Poonam Arora, Moira Zellner, and Balaji Rajagopalan

Focus: Model and understand the impact of changing transportation costs (rail lines, water transportation) on agricultural productivity against a backdrop of climate change in an expanding region of Argentinian agriculture.

Systems of Cities: Simulating Urban Landscapes, Networks, and Climate (2015)

Early Career Research Program, Department of Energy

5-Yr proposal to represent the human component of the earth system in global climate models (such as CESM) by focusing on cities as nodes in global network. Cities have a key role in driving landscape change and causing changes in emissions; cities are well-studied and heavily modeled; and cities will respond to climate change, allowing improvement of current global models.

Forecasting Long-range Outcomes for Water Systems (2015)

NSF: CNH

With: Lilian Alessa, Andrew Kliskey, Richard Lammers, Jonathan Ozik

Focus: Develop a data mining and simulation modeling platform to understand the dynamics of water resource allocation and the conditions under which conflict over these resources may arise, both within the U.S. and globally.

Water for crop production and environmental systems: Effects of drainage water management on competing ecosystem services in large intensively managed agricultural watersheds (2015)

USDA/NIFA

With: Ximing Cai (lead) et al.

Focus: Develop a model of management of water at drainage basin level, building on earlier work with formal arrangements among farmers in the U.S. Midwest for water management issues.

Developing a Methodology to Estimate the 5-10 Year Impacts of International Trade Policies, Using Empirical Data and ABM, for Senegal and Tanzania (2015)

NSH: SBE-RCUK (Joint with European Research Council)

With: Thomas K. Park (lead), Mark Altaweel

Focus: Develop an agent-based model based on Transformational Growth Matrices (Edward Nell) that allows macro-level economic variables to be linked to micro-level agent-based model of individual strategies and explore the impacts of specific macro policies within specific contexts (Senegal and Tanzania and IMF restructuring policies).

Crop Production, Water Quantity And Quality In Large Heavily Managed Agricultural River Basins: Managing Land Drainage To Sustain Competing Ecosystem Services (2014)

USDA/NIFA

With: Ximing Cai (lead) et al.

Focus: Development of a Decision Support System to work with water management among farmers in small drainage basins (county-level), to be used to mitigate ecosystem vulnerability while maintaining agricultural production.

Archaeological and Anthropological Fieldwork

Bhubaneshwar, India *January-February 2001*

Project director: Monica L. Smith

Pedestrian survey, surface collection, and mapping project at Early Historic (250 BCE – 250 CE) walled city of Sisupalgarh.

Proyecto Bajo la Justa, Guatemala *March-April 1999, March 2000*

Project Directors: Vilma Fialko, T. Patrick Culbert, and Thomas Sever

Pedestrian survey using satellite imagery, GIS, and GPS to discern and ground-truth vegetation patterns coincident with Maya settlements within large seasonal swamps (bajos). Participated in data collection and post-fieldwork GIS analyses.

Pajarito Trails Survey *July 1999*

Project Director: James E. Snead

Pedestrian survey of prehistoric trails through regions of Bandelier National Monument, New Mexico. Exploratory study using GPS to collect data on short- and medium-length human-made trails.

Excavations at Aguateca, Guatemala *May 1999*

Project Directors: Takeshi Inomata and Daniela Triadan

Excavations at a catastrophically abandoned Late-Classic palace complex at a prominent site in the far western region of Guatemala. Participated in data collection (excavation, illustration, mapping), data management, and analysis.

Longitudinal Bone Density Study *September 1998*

Project Director: William A. Stini

Assisted in the collection of bone density study among elderly volunteer subjects in Sun City, Arizona. Duties included equipment set-up, operating computer-controlled bone density scanner, light data management and patient interaction.

Itzán Archaeological Project, Guatemala *May-June 1998*

Project Director: Kevin Johnston

Pedestrian survey and excavation of 'non-mounded' Maya residences outlying a prominent Late Classic Maya center in the western Petén. Survey and mapping of several large but previously unreported Maya sites and palaces in the same region.

Athienou Archaeological Field School, Cyprus *Summer 1997*

Project Directors: Michael Toumazou, William Yerkes, and P. Nicholas Kardulias

Excavation of Archaic Greek sanctuary of Malloura; pedestrian survey of later Medieval settlement and comparison with abandoned Turkish village of Petrophani.

Organized Sessions

- *Sustainable and Environmental Applications*, Track Chair, with Jonathan Ozik, Winter Simulation Conference, Washington, D.C., 2016.
- *The Anthropogenic Earth System: Modeling Social Systems, Landscapes, and Urban Dynamics as a Coupled Human+Climate System up to Planetary Scale*, with Moira Zellner and Tatiana Filatova, Conference on Complex Systems, Amsterdam, The Netherlands, 2016.
- *Agricultural Landscapes as Complex Systems*, with Moira Zellner, M. Cristina Negri, and Silvia Secchi, Conference on Complex Systems, Tempe, Arizona, 2015
- *Complexity and Global Security: Sustainability in an Increasingly Connected World*, with Shade T. Shutters et al., Conference on Complex Systems, Tempe, Arizona, 2015
- *Sociohydrology: Modeling Feedbacks in Complex Coupled Natural Human Water Systems (Panta Rhea- Everything Flows)*, with Arne Bomblies, Tara Troy, and Charles Kroll, American Geophysical Union Fall Meeting, San Francisco, CA, 2014
- *Archaeological Simulation Modeling as Computational Social Science: Next Steps Forward*. With Mark Altaweel. Computer and Quantitative Applications in Archaeology Annual Conference, Southampton, UK, 2012.

Invited Talks, Lectures, and Workshops

Workshop: Resilience and Sustainability: Past Trajectories, Contemporary Directions, Policy Relevance, organized by John Haldon, Princeton University, June 2024.

Workshop: Living Through Crises, organized by Aeron O'Connor. University College London, May 2023

Workshop: The 25 'Great Challenges' in Archaeology through an ABM perspective, organized by Iza Romanowska, Maja Gori, and Vander Linden. Lorentz Center, Leiden, September 2022.

Public Lecture: Garrod Research Seminar Series, Cambridge University "Modeling 'The Dawn of Everything': how simulating a complex yesterday might (or might not) help us with a complicated tomorrow". May 19th, 2022.

Workshop: *If the past teaches, what does the future learn? [IHOPE], 3 Sessions, October 2018 - October 2019, SESYNC, Annapolis)*

Workshop: *Emergence of Social Complexity through Human-Environment Relations (ESCHER). February 2018, TU Delft.*

Workshop: *Framework for Integrating the Complexity of Urban Systems (FICUS) and Open Modeling System (OMS) Workshop (August 2016, University of Illinois Urbana-Champaign) [Participant]*

Workshop: *Risk, Disasters, and Need-Based Transfers (January 2016, Athena Aktipis & Lee Cronk) [Presenter/Participant]*

Public Panel: *Body of Water: Climate Change and Human Rights (ArtWorks Chicago, December 2015) [Panelist]*

Tutorial: Repast Simphony and Agent-Based Modeling *(November 2015, University of Oregon) [Presenter]*

Workshop: *Need-Based Transfers in Disaster Recovery and Resource Management (January 2015, Athena Aktipis and Lee Cronk) [Presenter/Participant]*

Public Panel: *Water-Climate Briefing, Arizona State University: "Sharing Risk and Resources in Water Management: Need-based transfers from small-scale societies to large-scale systems." [Panelist]*

Workshop: *E4 Global Human Ecodynamics Alliance meeting (Girdwood, Alaska, February 2013) [Presenter]*

Workshop: *Best Practices for Integrating Social Sciences in Sustainability Research and Education: Future Directions and Challenges for Integrative Research (Chicago, October 2012) [Participant]*

Tutorial: Agent-Based Modeling on Parallel and High-Performance Systems: Theory and Practice *(Computational Social Science Society of the Americas, Santa Fe, NM, October 2012)*

Tutorial: Repast HPC *(University College London, March 2012)*

Presentation: Repast HPC on the Blue Gene/P *(Argonne National Laboratory Leadership Computing Facility, October 2011)*

Software Tools Authored

RHPC_SMPLE (Release Fall 2021)
General toolkit for simulating social media platforms and social media users. Allows fast implementation of platforms' specific features, and development of the platform as a strategic agent. Permits large-scale simulations of tens of thousands of users, and potentially parallelizable for even larger scales.

GDELT-GA-SEARCH (Release Fall 2021)
Permits establishment of subset of relevant GDELT events and mentions based on correlation and/or prediction of time series (e.g. social media activity counts). Search moves through the complex feature space of GDELT events to find criteria that are most related to the activity being tested. Permits flexible definition of relevance criteria and prediction methods.

Repast HPC (Lead Developer, 2012-2016)
Implementation of the Repast Agent-Based Modeling toolkit for High Performance Computing environments; contributions include improved performance for some core features and implementation of other features needed for specific ABM projects.

Water Skimmer
Natural-Language Processing tools for named-entity recognition and identification of water management entities. Includes the ability to differentiate between names of management institutions and spurious matches such as roads or people. Permits the construction of networks of related managers based on document co-location. Uses Apache UIMA framework.

SWIM (Simulating Water, Individuals, and Management)
Permits the construction of networks for water distribution; water flow is time-based and negotiated across arbitrary time intervals from upstream distributors to downstream consumers. May be used to model regional distribution down to household level.

J-SENSE
Java-Based Social Evolution Network Statistics Engine. Permits calculation of relatedness coefficients (Hamilton's r) on sociomatrices, and allows calculation of relatedness due to population structure and assortment.

J-SNAP
Java-Based Social Network Analysis Package. Provides a convenient and extensible wrapper for using Jung, Pajek, or R (sna) to perform Social Network Analysis on evolving or immutable networks during agent-based simulations.

ABCM
The Assertion-Based Computer Modeling Framework. Permits linking a simulation system to a database, to permit flexible construction of multiple variations of a simulation while maintaining an audit trail and linking input and output data with all code versions. (Part of HWM project, above.) Implementations in Java and C++.

FlowAG
A toolkit for modeling irrigated agriculture. Includes algorithms for construction of detailed canal systems (slope, profile, Manning coefficient), plant soil chemistry, and field water management, and plant growth. Constructed in the ABCM framework. (Part of HWM project, above.)

Monte Carlo Affiliation Matrix Statistics Calculator
Calculates affiliation statistics given subgroup observations in a multiple observer affiliation matrix using Monte-Carlo approach. In MS-Excel.

ReFACE
Allows declarative definition of disease characteristics to be imported into agent-based models. Diseases permit condition transitions from one disease state to another and activity-based transmission. In C++.

Professional Activities

Member: American Anthropological Association; Society for American Archaeology; Society for Applied Anthropology
Communications Coordinator, Computational Social Science Society of the Americas, 2011-2014
Member, CoMSES Network for Community of Modelers in the Socio-Ecological Sciences
Editor, CoMSES Digest, 2013-2020
Member, CoMSES Interim Executive Board and Executive Board, 2013-2015.
Peer reviewer for: *Current Anthropology*, *Journal of Artificial Societies and Social Simulation*, *Latin American Antiquity*, *Complex Adaptive Systems Modeling*, *Journal of Archaeological Method and Theory*, *Transactions on Modeling and Computer Simulation*
Program Committee/Reviewer: Computational Social Science Society of the Americas Annual Meeting, 2012 – 2016, 2021; Multi-Agent-Based Simulation (MABS), 2013, 2014, 2016; Water History 2015; Computer Applications and Quantitative Methods in Archaeology, 2011-2016.

Teaching & Lecturing

Courses/Guest Lectures

Honors Faculty Fellow: “Data and Power”. Honors Seminar on Computational Social Science at Northern Illinois University, Fall 2021.

Environmental Systems Analysis, *U. of Illinois Urbana-Champaign, Ximing Cai, Spring 2016*

- Lecture: *Agent-Based Modeling for Socio-Ecological Simulation and Landscape Transformation*

NRES Seminar Series, *University of Illinois Urbana-Champaign, Bethany Cutts, Spring, Fall 2015*

- Lecture: *Agent-Based Models of Agricultural Landscapes: Understanding Transformations and Designing for Change*

Biology Colloquium, Illinois Institute of Technology, Fall 2011:

- Lecture: *Agent-Based Modeling: A Computational Approach to Understanding Complex Biological systems*

Ecology and Evol. Biology 446/546 *University of Arizona, John W. Pepper, Spring 2004*:

- Lectures: *Believing the Brochures: Bali as a Coupled Human and Natural Complex System; A RePast Tutorial*

Anthropology 560 *University of Arizona, Steven L. Kuhn, Spring 2002*:

- Lecture: *Agent-Based Simulation Modeling*

Anthropology 553 *University of Arizona, Brian R. McKee, Summer 2000*:

- Lecture: *Classic Maya Political Organization*

Anthropology 198 *University of Arizona, William L. Rathje, Fall 1999:*

- Lecture: *The Real Mesoamerican Archaeologist*

Anthropology 315 *University of Arizona, Shannon Sparks, Summer 1998*

- Lecture: *Ethnohistory and Archaeology of the Inca Empire*

Students

Senior Capstone, Lila Zayed, “JLootbox: An Agent-Based Model of Social Influence and Gambling in Online Video Games”. Spring 2022.

Independent Study, Marin Wadsworth, Northern Illinois University. “Social Networks and Social Theory”; “Natural Language Processing”. Summer 2021.

M.A. Committee (external), Alex Cara, University of Cincinnati (Archaeology; Nick Dunning, Chair), completed 2018

Advisor, Nini Gu, for MS Environmental Science joint U Chicago/Argonne program, Harris School of Public Policy

Teaching Positions (Post-Secondary)

Graduate Teaching Assistant, INDV 102 "The Many Ways of Being Human," for Dr. Trudy Griffin- Pierce. Fall 1999. Two discussion sections.

Graduate Teaching Assistant, Anthropology 110 "Popular Archaeology," for William L. Rathje, Fall 1998. Two discussion sections.

Teaching Positions (Secondary)

Tutor for Ohio High School Proficiency Tests (Citizenship), Worthington Kilbourne High School, 1994-1995.

Substitute Teacher, Newark City Schools, Newark, Ohio and Worthington Schools, Worthington, Ohio, 1993-1995.

Student Teaching, Cooperating Teacher: Stanley K. Ray, Franklin Heights High School, Columbus Ohio, Spring 1993. Grade 9 general social studies course "Global Studies."

Awards and Funding

At Argonne National Laboratory

• Secretary of Energy Achievement Award 2024 (part of Puerto Rico Grid Modernization and Recovery/PR100 project team)

At the University of Arizona

• Social and Behavioral Sciences Fellowship (Fall 1997 - Spring 2001)
• Department of Anthropology Graduate Tuition Scholarships (with SBS Fellowship)
• Department of Anthropology Graduate Registration Scholarships (with SBS Fellowship)
• Comins Fellowship Departmental Scholarship (Fall 1998 and Spring 1998)
• Haury Departmental Scholarship (Fall1998)
• Organizer, Agent-Based Modeling Group (interdisciplinary, campus-wide)
• Graduate Co-President, Anthropology Club (Spring-Fall1998)
• Editor, Arizona Anthropologist, Issues #13 (1999) and #14 (2001)
• Honorable Mention: All-Campus Leadership Award: Outstanding Graduate Student Leader, Doctoral Level, 2003

At Ohio State University

• National Merit Scholarship
• Ohio Board of Regents Scholarship
• Phi Beta Kappa (inducted June 1991)
• Undergraduate Representative to Ohio Area Art History Conference, April 1991
• Stanley J. Karl Award for Outstanding Undergraduate Essay, 1991
• Study tour to Isthmia, Greece, Spring Quarter 1991
• Athienou Archaeological Project Summer 1997 Field School, funded by a $3,000 grant from the National Science Foundation
• Undergraduate Anthropological Society, Co-Coordinator, 1996-1997

Selected Consulting and Employment History

Consultant (Simulation Modeling) *June 2008*
Employer: Ann P. Kinzig, Global Institute of Sustainability, Arizona State University
Continued work on HWM Simulation

Consultant (Simulation Modeling) *April 2006 – December 2008*
Employer: Lisa M. Curran, Santa Fe Institute and Yale University
In conjunction with masting synchrony simulation (see above)

Consultant (Simulation Modeling) *June – December 2007*
Employer: J. Stephen Lansing, Santa Fe Institute
In conjunction with SAIL Simulation project (translated LISP to Repast Simphony, with Argonne National Laboratories).

Research Professional, Arizona State University *January – March, 2007*
Supervisor: William Griffin
Translated 'PlayMate' simulation model of child playground interaction from Python to Java, for implementation in Repast (versions 3.0 and Simphony).

Academic Professional, Arizona State University *July 2003 – December 2005*
Supervisors: Ann P. Kinzig, Charles Redman
Initial work on HWM Simulation (see above).

Graduate Research Assistant, University of Arizona *Fall 2001 – Spring 2003*
Supervisor: J. Stephen Lansing
In conjunction with SAIL Simulation

Consultant (Database Specialist) *April 2003 – August 2005*
Employer: Norma Maynard, University of Arizona
In conjunction with AnthInfo database

Graduate Research Assistant *Spring 1999 – Spring 2002*
Supervisor: Norma Maynard; with Mary Ellen Morbeck
In conjunction with AnthInfo database and Primate Anatomical Database (see above).

Consultant (Database Specialist) *Fall 2001*
Employer: Christopher Tillquist, University of Kentucky
Construction of a database in Microsoft Access of genetic samples, including input and output routines and simple analysis tools.

Consultant (Database Specialist) *Fall 2001*
Employer: Takeshi Inomata, University of Arizona
Limited consultation on a Microsoft Access database project storing information on artifacts from the Aguateca archaeological site.

Data Entry, AZSite Project, Arizona State Museum *June 1999 – August 1999*
Supervisor: Rick Karl
Worked with geographically referenced database project of all archaeological sites cataloged in Arizona; data entry and digitization into MS-Access database and ArcView GIS system.

Personal Computer Analyst *1996 – 1997*
Employer: National Revenue Corporation, Reynoldsburg, Ohio
Special assistant to two Vice Presidents; created special-purpose tools for analyses of various databases and structured reports. Major project: data processing, integration and analysis routines on 3 DAVOX (UNISON) automated dialer systems' daily reports.