

Applicant Information

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Professional Development

Education

2000 PhD, School of Geography & Geology, McMaster University
1994 M.A., Department of Geography, University of Western Ontario
1991 B.A. (Co-op & Honors), Saint Mary's University

Employment History

July 2002 – present, Assistant Professor (Associate effective 1 July 2006), School of Geography and Earth Sciences, McMaster University, Hamilton, Ontario, Canada

July 1999 – June 2002, Assistant Professor, Department of Geography and Geosciences, University of Louisville, Louisville, Kentucky, United States

Research Interests

Activity-based approaches to travel analysis and modeling, geographic information systems for transportation, integrated land-use and transportation models, object-oriented microsimulation, spatial analytical issues (modifiable areal unit problem), sustainable transportation (congestion, emissions, aging populations), time geography

Workshop Contributions and Expectations

In addition to the items listed above, my professional development includes extensive training in quantitative methods (statistics, econometric modeling) and GIS, and the application of these tools in the field of transportation, broadly defined. In fact, to support my research in travel behavior analysis and modeling, I have had to develop customized GIS tools to delineate space-time prisms (Scott, 2005; 2006) and space-time paths – the latter, within a household context. These tools are not merely used for visualization, but are used to derive data for input to models designed to understand processes (e.g., destination choice) and human interactions (e.g., joint activity participation). I have also developed a new econometric model, the trivariate ordered probit model, to account for interactions among decisions and/or decision makers (Scott and Kanaroglou, 2002). Broadly speaking, much of my research program falls under integrated land-

use and transportation models, developed at both the micro- and macro-levels (Kanaroglou and Scott, 2002; Scott et al., 1997). Such models are designed to capture dynamics, at various spatial and temporal scales, in the urban system. Moreover, they are policy oriented.

Given the above, I can contribute to the dynamics workshop in several ways. First, my training in GIS and development of spatio-temporal tools in GIS means that I can speak to the merits and challenges of such development, not to mention provide solid examples of said research. Second, my used of econometric methods, in particular discrete choice models, means that I can discuss the need to elicit “quantitative” information from GIS as input to understanding processes and interactions. Third, I can also discuss the merits and challenges associated with GIS-based integrated urban models, which are designed to simulate an evolving urban area. Moreover, I have experience in contributing to the development of micro-level, or agent-based models, as well as more traditional, macro-level models, which are developed at the zonal level.

Among my expectations, I believe that interaction with intelligence representatives would shed considerable light on needs of said user community – the potential recipients of the spatio-temporal tools developed by academic researchers. As part of this, I would expect the workshop attendees in conjunction with the intelligence representatives to develop a listing of state-of-the-art spatio-temporal tools and their applications and target communities, and a listing of challenging applications for which spatio-temporal tools and analysis are needed. Perhaps workshop attendees could discuss the possibility of commercializing tools so that they are more accessible to the user community. Finally, I hope to learn from the experiences of others attending the workshop.

Vision

As mentioned above, much of my research program focuses on the dynamics of urban systems. Such dynamics includes interactions among actors within the system and their evolution over time. The development of policy-oriented, behaviorally-sound integrated urban models presents many research challenges including data collection, representation of space (frameless or zonal) and representation of time (many processes operate at different time scales). It is my belief that the workshop must include some discussion of simulation, both micro and macro, as an important tool for modeling spatio-temporal dynamics. We can learn much from spatio-temporal empirical studies that look to the past. However, policy relevance and application must be geared toward the future. Our tools must be capable of predicting multiple future states given changes to policy sensitive variables (i.e., different scenarios).

Research Synopsis

The above paragraphs describe the basic components of my research program related to spatio-temporal analysis and modeling. One topic that I have yet to mention is my recent work on identifying critical transportation infrastructure. This topic may be of particular interest to the intelligence community representatives at the workshop. In essence, some colleagues and I have developed a metric that quantifies the “vulnerability” of surface network (highway, rail) links, from a system-wide perspective, to natural or human-induced disruptions (Scott et al., 2006). The metric is called the “Network Robustness Index” or NRI. The software for computing the

metric is developed within a GIS and requires as input only a network and origin/destination traffic flow matrix. The metric can be extended to the Internet. An important area of research concerns spatio-temporal change and its impact on critical infrastructure. Simply put, critical links change over time due to changes in land-use patterns and resulting changes to traffic flows. A large-scale project is currently underway examining the impact of land-use change on critical links in the Greater Toronto Area over the period 1986 to 2001.

One can envision many ways in which various organizations can employ the Network Robustness Index. Emergency management organizations, for example, after identifying critical links, could draft link-specific contingency plans for rerouting traffic should a natural or human-induced incident necessitate the closure of a critical link. In an era of heightened security due to threats of terrorism, critical links could be targeted for enhanced surveillance either through the installation of cameras or more highway patrols by policing organizations. Like emergency management organizations, firms involved in supply-chain management may also want to prepare link-specific plans to ensure that their customers' needs continue to be met in the event of a network disruption. Finally, planning organizations may seek to enhance the reliability and flexibility of existing networks by recommending the construction of new links in areas identified by the NRI as being particularly crucial to overall system performance.

Research Leadership

I can provide leadership at the workshop on several fronts: (1) development of GIS-based spatio-temporal tools for the visualization and analysis of activity-travel behavior; (2) development of large-scale GIS-based integrated land-use and transportation models for modeling urban processes and spatio-temporal dynamics (both micro and macro models); (3) discussion of the merits and challenges associated with micro- and macro-simulation; and (4) discussion of critical infrastructure (which is likely important to the intelligence community representatives) and the role that spatio-temporal change plays in its identification.

References

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- Scott, D.M. (2006) Constrained destination choice set generation: A comparison of GIS-based approaches. *85th Annual Meeting of the Transportation Research Board: Compendium of Papers CD-ROM*, Washington, D.C., January 22-26.
- Scott, D.M. (2005) Approaches to generating constrained destination choice sets using GIS. *Computers in Urban Management and Urban Planning (CUPUM) 2005*, London, United Kingdom, June 29-July 1.
- Scott, D.M. and Kanaroglou, P.S. (2002) An activity-episode generation model that captures interactions between household heads: Development and empirical analysis. *Transportation Research B: Methodological*, 36: 875-896.
- Scott, D.M., Kanaroglou, P.S. and Anderson, W.P. (1997) Impacts of commuting efficiency on congestion and emissions: Case of the Hamilton CMA, Canada. *Transportation Research D: Transport and Environment*, 2: 245-257.
- Scott, D.M., Novak, D.C., Aultman-Hall, L. and Guo, F. (2006) Network robustness index: A new method for identifying critical links and evaluating the performance of transportation networks. *Journal of Transport Geography*, in press. Copy available at <http://sciwebserver.science.mcmaster.ca/cspa/papers/CSpA%20WP%20009.pdf>