Moving agents in geosimulation

Dr. Paul M. Torrens

Associate Professor, Geosimulation Research Laboratory, School of Geographical Sciences & Urban Planning, Arizona State University, Tempe, AZ 85287-5302, USA

Keynote address, ICA Workshop on Geospatial Analysis and Modeling, August 10-12, Simon Frasier University, Burnaby, BC

Movement is a significant component of human geography. It is something that we learn to do from a very early age and it is something that most of us continue to do every day. While we may often take it for granted, movement is an intricately complex behavior that involves simultaneous resolution of a range of skills and abilities. To move, one must acquire a wealth of dynamic geographic information using relatively limited human senses, sort and prioritize that information, process it using spatial thinking, and produce useful geographic behavior. Those behaviors control a range of processes at varying spatial and temporal scales, from muscle control and vision to steering and trip-planning. The substantive impact of our movement is equally important, providing significant input to transport systems, architecture, civil engineering, health, mobile informatics, retailing, and marketing to list just a few. Yet, our models of movement are often abstract and coarse. They are coarse because they tend to focus on crowd flow, rather than the movement of individuals. They are abstract because they are based on physical models of particle interaction in granular media, or on search heuristics in informatics. This is particularly true for many agent-based models, which is ironic when agent-based schemes are being advertized for their ability to mimic real-world behaviors and to be mapped to individual-scale agency. Cursory models of movement constrain the range of questions that can be posed in simulation and limit the range of applications and explorations that they can be put to. In this talk, I will present a novel scheme for representing movement in agent-based models, one that treats the diverse and simultaneous components of geographic behavior at their characteristic spacing and timing. This is achieved using geographic automata as building blocks for geographic behavior, Geographic Information Science as a scheme for reconciling synthetic geographic abilities, techniques from computer animation and special effects for animating simulated processes through space and time, and machine-learning to ally models to real-world data. I will demonstrate the usefulness of the approach with applications to quotidian and extraordinary movement scenarios for pedestrian movement.