Keith Warren
Assistant Professor
College of Social Work
The Ohio State University

The Intersection of Agent-Based Models, Land Use and Community Mental Health

I am probably unique among participants in the workshop on agent-based models of land use/land cover change in that my primary research interest lies in community mental health. Thus, my deepest interest is not so much land use itself as the effects of that use on the human psyche. I am particularly interested in individuals who suffer from chemical dependency and severe and persistent mental illnesses such as schizophrenia and bipolar disorder. However, it is not unreasonable to think that different types of land use might affect the stress level and therefore the mental health of individuals who carry no actual psychiatric diagnosis (Halpern, 1995; Ulrich, 1993). This abstract will therefore discuss research that would touch on the needs of considerably divergent populations. I should add that I am only in the beginning stages of planning these lines of research.

There is a rich and varied literature that addresses the effect of the built environment of buildings, streets and landscaped parks on human behavior and mental health (Bechtel, 1997; Gifford, 1997; Halpern, 1995). There is a parallel, and sometimes overlapping, literature that addresses the effect of the unbuilt, "natural" environment on human mental health (Kahn, 1999; Kellert, 1997; Kellert & Wilson, 1993). Much of this latter literature derives from the "biophilia" hypothesis, first stated by Edward O. Wilson, that human beings have an inbred need to affiliate with life and the broader ecological system. However, the built environment is entirely, and the natural environment is largely, the result of human actions and interactions (Meyer & Turner, 1994). To look deeper, to understand how the landscapes that affect us arise, we need to understand how these interactions occur. Agent-based models constitute a natural framework for thinking about such interactions.

For instance, the Not In My Backyard (NIMBY) phenomenon, in which homeowners oppose the location of residential facilities for individuals with chronic mental illness in their neighborhood, has blocked construction of as many as half of all planned group homes for people with disabilities in the United States (Tse, 1995). NIMBY has probably contributed to the concentration of people with chronic mental illness in relatively impoverished inner-city neighborhoods, whose residents are less likely to be able to organize against residential facilities (Levine & Perkins, 1997). Administrators have attempted to alleviate NIMBY by meeting with prospective neighbors of proposed facilities (Zippay, 1999), but fundamental questions about NIMBY, such as the motivations of homeowners and how far the effect reaches, remain poorly understood (Colon & Marston, 1999; Gilbert, 1993; Mangum, 1988). Agent-based models, incorporating the bounded rationality of homeowners and distance effects, could be useful in generating more precise hypotheses than the ones that currently

characterize the literature and in thinking about the implications of the somewhat contradictory empirical findings.

There is evidence from both qualitative and quantitative studies that social support can significantly benefit those who suffer from a variety of mental illnesses (Marsh, 2000; Paykel, 2001). There is also evidence that the built environment heavily influences both the quality and quantity of social support. The conditions for strong social support networks are complex. The opportunity to interact with others is, of course, necessary, but so is the ability to control such interactions. An environment such as a busy street that forces interactions with others actually tends to lead to hostility to neighbors (Halpern, 1995). A particularly unpleasant environment can make social interactions far more difficult, while some level of local social heterogeneity appears to foster social networks (Halpern, 1995). Agent-based models are natural tools both for studying the way in which different built environments arise and for developing a better and deeper understanding of the effects of those environments on social networks.

Agent-based models of land use could also yield considerable insight into the origin and effects of such environmental stressors as weather, air pollution and noise and crowding (Halpern, 1995). There is evidence that cloudy weather has a negative effect on mental health (Halpern, 1995). Cities tend to be more cloudy, more rainy and more foggy than the surrounding countryside (Rogers, 1994), and it is possible that this has an adverse effect on the mental health of some urban residents. Levels of environmental noise and crowding are, to a large extent, the straightforward result of urban and suburban development patterns (Halpern, 1995). In all of these cases ABMs could be of great value in modeling the interactions that lead to changes in land use, as well as the interactions between those who live in urban and suburban areas, their environments and each other.

There is also evidence that exposure to natural environments improves both mental and physical health (Kahn, 1999). Many studies have shown that subjects prefer natural scenes, particularly those that show fairly open landscapes with a scattering of trees and those that include water, to built scenes (Ulrich, 1993). There is substantial evidence that many people find that natural settings, whether they are wilderness areas or urban parks, reduce perceived stress (Ulrich, 1993). There is even evidence that postoperative hospital patients recover more quickly when they have a window that overlooks a natural scene, when compared to those who have a window that overlooks a brick wall (Ulrich, 1993). Human interactions, policies and land use largely determine where natural environments remain and how easily individuals can gain access to them. All of these, of course, can potentially be modeled through ABMs. Moreover, findings of positive effects of natural environments on mental health would have implications for models of the response of land values to natural amenities, such as Irwin & Bockstael, (2001), since they might allow a more accurate quantification of the value of access to those amenities.

There is substantial evidence that both the natural and built environments have significant effects on human mental health. ABMs seem likely to be of considerable

value both in developing a more detailed theory of those effects and in understanding the human interactions that give rise to much of the world in which we live.

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