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Three Contexts of Appropriation for an Urban Simulation System

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Abstract. UrbanSim is an integrated land use and transportation simulation system. Its purpose is to help inform public deliberation and decision-making regarding major land use and transportation decisions, by simulating the consequences of different alternatives for an urban region over periods of twenty to thirty years. Indicators provide the primary tool for portraying key results from the simulations to users. We describe three contexts of appropriation for UrbanSim. The first is appropriation by different metropolitan regions, to simulate urban development in those regions. The second is appropriation by advocacy groups, business associations, and other organizations, who can use an Indicator Perspectives mechanism to present their particular viewpoint on what is important to measure in the simulation results and how it should be interpreted. The third is appropriation by individuals, using Personal Indicators to help understand how decisions would affect them personally.

Introduction

In many regions in the United States and globally, there is increasing concern about pollution, traffic jams, resource consumption, loss of open space, loss of coherent community, lack of sustainability, and unchecked sprawl. Elected officials, planners, and citizens in urban areas grapple with these difficult issues as they develop and evaluate alternatives for such decisions as building a new rail

line or freeway, establishing an urban growth boundary, or changing incentives or taxes. These decisions interact in complex ways, and, in particular, transportation and land use decisions interact strongly with each other. To help the understanding of the long-term consequences of these decisions, Waddell, Borning, and their colleagues have been developing UrbanSim, a large simulation package for predicting patterns of urban development for periods of twenty years or more, under different possible scenarios (Waddell and Borning, 2004). UrbanSim's primary purpose is to provide urban planners and other stakeholders with tools to aid in more informed decision-making, with a secondary goal to support further democratization of the planning process.

As Schmidt (1991) points out, models are limited abstractions and must evolve with the world they reflect. Users should be able to appropriate systems creatively to adapt them to particular situations. One important characteristic of the urban planning domain is that it centers on public deliberation and decision-making involving multiple stakeholders, who often have very different values and perspectives with respect to land use and transportation. Furthermore, each region in which UrbanSim has been applied has unique physical, social, and political characteristics. In this position paper, we discuss three contexts of appropriation of UrbanSim: by urban planners and modelers in different urban regions, by advocacy groups and other organizations, and by individual citizens. The first is operational and the others in the early design stages.

Appropriation by Different Metropolitan Regions

From the start of the project, UrbanSim has been designed as a reusable modeling system, for use by many different metropolitan regions—which, given the variation among regions, requires that it be designed for appropriation by urban planners and modelers. To date, UrbanSim has been applied experimentally in the U.S. in metropolitan regions around Eugene/Springfield, Oregon; Seattle, Washington; Honolulu, Hawaii; and Salt Lake City, Utah. Working largely independently of the UrbanSim team, groups have also experimentally applied UrbanSim in Houston, Texas; Phoenix, Arizona; Paris, France; and Tel Aviv, Israel; with other applications in process. UrbanSim played a significant role in an out-of-court settlement in Utah regarding a major freeway construction project (Waddell and Borning, 2004). The first major use in a public planning process is scheduled to begin in the Puget Sound (Seattle) region in summer 2005.

To enable the UrbanSim software engineering team to respond more readily to requests from modelers applying the system in different regions, the system architecture uses a collection of component models that interact via a shared database rather than by invoking each other directly (Noth et al., 2003). This modular architecture, implemented in Java, makes it easier to modify individual component models without modifying other components of the system. The team

also uses an agile development methodology (Freeman-Benson and Borning, 2003), to be more flexible and responsive to modeler requests.

Licensing UrbanSim under the GNU Public License is another important step in supporting appropriation for different regions. While open source licensing is familiar in computer science, it is less common in urban modeling. Most urban simulation systems are proprietary, and there are a variety of barriers to sharing code improvements among the government agencies in different regions. By contrast, UrbanSim is freely available for download from the project website (http://www.urbansim.org). Downloadable information includes the source code, executable code, a sample dataset, and a user manual.

As open source software, all parts of the system can be modified by the end users, but of course this is not always easy in practice. One part of the system where such extension is more straightforward is in the mechanisms for computing and viewing indicators. In urban planning, indicators are often used to monitor changes in a region with respect to specific attributes of concern. In UrbanSim, simulation results can be presented using the same set of selected indicators for all the policy alternatives being considered, aiding the assessment and comparison of different scenarios. To make it easier to modify or add new indicators, raw simulation results are stored in an SQL database. The indicator computations are then expressed as SQL queries, decoupling them from the simulation itself. We have also done considerable design and testing work on the indicator documentation and interface, addressing issues such as information fragmentation and transparency of the system, and ensuring that documentation about the indicators is ready-to-hand in the course of using them (Borning et al., 2005).

The software engineering group had hoped that writing the Java source code well, with good abstractions, coding style, comments, and documentation, would enable the domain experts (modelers) to read the code and make some changes—in other words, to support a further level of appropriation. However, this rarely happened in practice, because modelers found Java and its interactive development environment too daunting. However, the software engineering group found that the modelers *are* willing to read and write in a high-level scripting language, namely Python. Another factor has been a desire to join forces with other land use and transportation modeling groups world-wide, to provide a common platform and system that enables greater sharing and collaboration. In response, the group has built a new Python framework, the Open Platform for Urban Simulation (OPUS), and begun the process of converting UrbanSim to be built on this framework. We have already found that the modelers are indeed willing to read and make simple changes to the Python code.

As another step toward supporting appropriation by the wider community of modelers, a group at the University of Massachusetts has established the UrbanSim Commons (http://www.urbansimcommons.org). The UrbanSim

Commons provides a place where UrbanSim users and developers can share knowledge and experiences.

Appropriation by Organizations

A recent paper (Borning et al., 2005) discusses the development of Technical Documentation for UrbanSim indicators, guided by the Value Sensitive Design theory and methodology (Friedman et al., in press). As much as possible, the Technical Documentation is intentionally neutral, and does not advocate for any particular use of the indicators to evaluate policy alternatives. Yet, the planning process is rife with strong opinions and perspectives. Indicator Perspectives support organizations in appropriating UrbanSim indicators and simulation results to advocate for their own positions. In the Indicator Perspectives section of the UrbanSim website, a set of organizations each present their own views on which indicators are most important for evaluating policy alternatives, and how those indicators should be interpreted. We believe that these perspectives will be also useful to stakeholders and decision makers because the organizations have well thought-out positions and can present them clearly and coherently. Indicator Perspectives are intended to provoke thought and public deliberation, as well as to give groups a venue in which to state their positions.

We are currently in the early stages of developing Indicator Perspectives. We have partnered with three local organizations to construct perspectives for the initial prototype: a government agency (King County Budget Office, which publishes the King County Benchmark Reports), a business association (Washington Association of Realtors), and an environmental group (Northwest Environment Watch). Later, we plan to provide opportunities for involvement to all who are interested, actively soliciting partners as needed to help ensure continuing coverage of the political and policy space.

Appropriation by Individuals

A natural question for any citizen learning about a new government policy is, "How will this affect me?" A new mechanism under development, Personal Indicators, is intended to address this question for land use and transportation policy alternatives simulated with UrbanSim. As this question is necessarily tied to each citizen's particular situation, users of Personal Indicators will begin by providing some information via a web-based interface about their situation, such as the neighborhoods in which they live and work, approximate household income, and the number of adults and children in the household. Values of Personal Indicators for the simulated future under each policy alternative would then be provided. Rather than reflecting the region as a whole, Personal

Indicators will reflect the user's individual and family situation: for instance, the amount of time required for the user's commute to and from work, the mix of commercial and residential construction in the user's neighborhood, and housing options throughout the region for similar households.

We hypothesize that Personal Indicators can help to engage citizens in the urban planning process by addressing the question, "How will this affect me?" They may also be more comprehensible to ordinary citizens than indicators at the metropolitan level, because they can be readily related to an individual's everyday experiences of living, working, and getting around in the region. However, Personal Indicators also raise significant questions for the use of UrbanSim in a democratic society. How can we resolve tendencies to take a short-term view of the future and with the long-term view required by regional planning? How can we balance an individual's self-interest with interests of other individuals and the good of the region as a whole? How can citizens using Personal Indicators engage in deliberation when each has a different view of the future?

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