Household Indicators: Design to Inform and Engage Citizens

Janet Davis
University of Washington
Computer Science & Engineering
Box 352350
Seattle, WA 98195-2350
jlnd@cs.washington.edu

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ACM 1-xxxxxxxxxxxxxxxxx.

Abstract
Urban simulation systems can be a powerful tool for helping to understand the complex, long-term consequences of land use and transportation policy decisions. Simulation results are summarized and reported using indicators, aggregate measures such as population density or total minutes of vehicle delay. To citizens, these indicators may seem abstract and unfamiliar. This extended abstract presents design work in progress on Household Indicators, a new form of indicator designed especially for citizens. Accessed through a web-based interface, Household Indicators are intended to inform citizens by relating simulation results to citizens' life experiences, and to engage citizens by addressing the question, "How will this decision affect me?"

Keywords
Community computing, digital government, multidisciplinary design/interdisciplinary design, design rationale, World Wide Web and hypermedia.

ACM Classification Keywords
H5.2. Information interfaces and presentation (e.g., HCI): User interfaces. I6.3. Simulation and modeling: Applications. I6.6. Simulation and modeling: Simulation

output analysis. General Terms: Design, Human Factors.

Introduction

In many regions in the U.S. and internationally, elected officials, planners, and citizens grapple with issues such as traffic jams, resource consumption, and urban sprawl. Decisions such as whether to build a new freeway, expand transit service, or change land use regulations interact in complex ways and have long-term consequences. UrbanSim, a simulation package developed at the University of Washington, is intended to help stakeholders understand these consequences by projecting patterns of urban development for patterns of twenty years or more under different scenarios [8].

In urban planning, indicators [3] 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, thus aiding the assessment and comparison of different scenarios. For example, suppose that we are interested in fostering compact, walkable neighborhoods within the urban area, and curbing low-density, auto-oriented development ("sprawl"). In the urban planning literature, population density is regarded as one of the key indicators of the character of development. We can monitor population density to understand current trends, and also use UrbanSim to assess and compare the impacts of different policies on population density twenty years in the future.

Indicators such as population density, jobs-housing balance, and total vehicle miles traveled are familiar to urban planners engaged in monitoring and modeling trends. However, such aggregate measures may be less familiar and less compelling to citizens without expertise in urban planning. This suggests the development of new means to present simulation results.

A natural question for any citizen learning about a new government policy is, "How will this affect me?" Household Indicators will tailor UrbanSim results to show how policy alternatives could affect the user's own household. Using personal information provided by the user, this web application will address questions such as, "Where could I afford to live in the region?" "How long would it take to get to work?" and "Could my teenager find a part-time job near home?"

Household Indicators are intended to better inform and engage citizens in urban planning decisions. Initial user study results support the hypothesis that Household Indicators can be more readily understood by citizens than the existing indicators, because they can be more directly compared to citizens' experiences of living, working, and getting around in the region. Household Indicators are also designed to engage citizens by showing that regional policy decisions will have long-term impacts on their own lives.

This extended abstract presents work in progress on the design of Household Indicators. The next section …

Theoretical Framework: Value Sensitive Design

Development of UrbanSim is guided by Value Sensitive Design, a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive way [4]. In the Value

Sensitive Design methodology, three kinds of investigations are performed throughout the design process: conceptual investigations comprise philosophically-informed analyses of the values and design issues at play, empirical investigations focus on the human response to the artifact, and technical investigations focus on the design and performance of the artifact itself.

Another key aspect of Value Sensitive Design is its attention to both direct and indirect stakeholders—in the case of UrbanSim, we consider not only the urban planners who interact directly with the system, but also citizens who may not interact directly with UrbanSim but are affected by how its results are used. In developing a new means for citizens to interact with simulation results, this work aims to let more indirect stakeholders—citizens who are affected by how UrbanSim is used—become direct stakeholders able to interact with the system themselves.

The application of Value Sensitive Design to UrbanSim has involved a careful distinction between explicitly supported values (i.e., ones that we explicitly want to support in the simulation) and stakeholder values (i.e., ones that are important to some but not necessarily all of the stakeholders). Key among the explicitly supported values is a commitment to the democratic process. Informing and engaging citizens is instrumental to citizen participation in the democratic process. Although informing is near the bottom of Arnstein's ladder of citizen participation, it is prerequisite to higher levels of participation such as consultation, partnership, and citizen control [1].

To be an effective part of a democratic planning process, the use of UrbanSim must be seen as legitimate by the range of stakeholders. In earlier work, we identified Habermas's *legitimation potential* [5] as another key instrumental value to supporting the democratic process [2]. From legitimation potential, we derived several testable design goals for UrbanSim: that the information provided should be comprehensible to a range of stakeholders, that the models and results should be a reasonable representation of reality, that UrbanSim should be transparent with respect to its inner workings and design, and that UrbanSim should provide information that is both relevant and relatively free from bias.

Earlier work on the Indicator Browser focused on providing comprehensible, accurate, transparent, useful, and relatively neutral technical information to urban planners. By contrast, work on Household Indicators focuses on providing information that is comprehensible to citizens and relevant to their own lives, in order to better inform citizens' views and engage them in a democratic urban planning process. However, commitments to accuracy, transparency, and freedom from bias remain in effect. In particular, the commitment to accuracy requires that we not oversimplify or otherwise distort the world or the simulation models to present information that is more easily understood. The commitment to transparency presents the challenge of providing ready-to-hand explanations of where data comes from when questions arise. Citizens are unlikely to have urban planners' time and expertise, raising problems of intellectual access similar to those investigated by Marchionini *et al.* in presenting government statistics for citizen use [6].

Designing Household Indicators

After the initial conceptual investigations, design activities continued with an informal, semi-structured interview of nine Seattle citizens (4 women, 5 men) ranging in age from 31 to 49 (M = 36). These interviews were intended to assess the viability of the concept, determine which indicators are likely to be of interest to citizens, and explore the role of self-interest in opinions about urban planning.

Following this initial exploration, a series of paper prototypes were developed. These prototypes focused on a small number of indicators that interview participants expressed interest in and that the designer believed could be readily produced from existing UrbanSim output. Six participants (3 women, 3 men), ranging in age from 32 to 53 (M = 43.5) and again Seattle citizens, participated in user studies with these paper prototypes. From here, design has proceeded with the development of online prototypes using fake simulation data.

Screenshots of the current prototype interface are presented in Figure 1.

The next two sections present design rationale relating to the two major design goals: engaging and informing.

Designing to Engage

During the paper prototyping phase, two significantly different interaction patterns emerged: one taking an exploratory approach to viewing Household Indicators data (similar to that taken with dynamic queries [7]), and the other requiring the user to configure a household profile. Several user study participants preferred the exploratory approach, because no initial data entry is required. This approach also has the advantage that it allows users to easily explore the data, considering households other than their own or hypothetical changes to their own household in the future.

However, one of the two key goals for the system is to engage citizens by addressing the question, "How will this decision affect *me*?" This emphasizes exploring information relevant to one's *own* household as the common case. The household profile, which can carry the family name(s) of the user's own household, fosters a sense of identity that persists across the different indicators. Therefore, we have chosen to take the household profile approach in this prototype. Concerns about the time required to set up the profile are addressed by giving up front estimates of the small time commitment for data entry, and by giving examples of the kind of information the user will be able to access after creating a profile. Future versions of the system may combine both approaches, allowing the user to explore hypothetical variations on a household profile, for instance, living in a different neighborhood or having a fixed income after retirement.

Another key decision in designing to engage is the presentation of a question for each indicator. Like indicators typically used in urban planning, a household indicator must be an indicator *for* something that is of concern to the stakeholders. In the paper prototypes, individual indicators were simply given a title, such as "Access to Jobs" or "Housing Affordability." In the user studies, participants were unclear about the significance of the information and how it could be used. In fact, the designer realized that in one case,

the information presented did not address the question given in the user study task.

Now, each indicator display includes not only a title but also a question or a group of questions the indicator is intended to address. For instance, the "Access to Jobs" indicator, which reports the number of jobs within a certain travel time of the user's home, addresses the questions, "If you were looking for a new job, could you find one close to your home? Would your teenager need a care to have a part-time job?" These questions are intended to help users understand how the information might apply to their own lives.

The questions also serve to focus design and ensure the information is, in fact, relevant and accurately represented. For example, after the question, "How might the average price of homes in your neighborhood change?" was developed for one indicator, the title was changed from "Housing Affordability" to the more accurate "Average Neighborhood Home Price." This indicator is particularly interesting in that there are several very different reasons why one might be interested in the average home price in one's neighborhood. For example, one might wish neighborhood home prices to go up, increasing the sale price of one's own home. Or, one might wish prices to remain steady, to keep property taxes steady or to ensure other households like yours can afford to live in your neighborhood. In the interest of freedom from bias, the more generic question is used, and its implications are left to the user's imagination.

Designing to Inform

In designing to inform, the central hypothesis is that, by presenting information in terms that are familiar to the user, Household Indicators are more readily comprehended by citizens than the standard aggregate indicators. Early user study results and informal feedback support this hypothesis; in fact, there has been a push for greater realism and detail in reporting Household Indicators, making them even more directly related to citizens' experiences living in the region.

One case of this push is concerned with indicators of travel time between different places by various modes of transit (auto, public transit, walking, etc.). In the paper prototypes, a household indicator titled "Commute Times" presented the round-trip travel time from the user's home to various destinations during peak travel times. Although this relatively simple measure does give some indication of predicted changes in travel times, user study participants who travel at non-peak times, from starting places other than home, or to destinations other than work found it difficult to relate to. Colleagues also noted that a trip may include several stops; for example, a trip from home to work may include brief stops to drop a child off at daycare and to buy coffee. This phenomenon is called "trip chaining" by transportation planners. The result of this feedback thus far has been a new "Travel Times" indicator based on the user's description of trips, including not only a destination and a travel mode, but also a starting location and a time of day. Design of an interface that accounts for trip chaining is currently underway.

Another case is concerned with indicators of housing price. UrbanSim's models use a much simplified abstraction of housing, the *housing unit*. A housing unit has a monetary value, an age, and so forth, but it does not include characteristics such as square footage,

number of bedrooms, whether it is a single-family home or a flat in a larger building, or whether it is owned or rented by the occupants. This abstraction is familiar to many urban planners, but not so familiar to others without training in urban planning. At first, I thought that addressing this issue in the "Housing Affordability" indicator was a matter of transparency—carefully pointing out the differences between the housing unit abstraction and more typical conceptions of housing. The user studies disabused me of this notion. It is difficult to understand what a housing price means without knowing what that price is buying—say, a one-bedroom condo versus a four-bedroom house. Furthermore, the question, "Where can I afford to live?" is relative not only to one's income and other expenses, but also to the type of housing one prefers. Finally, many assumptions are required to translate a housing unit value into a monthly mortgage payment and even more to translate into a monthly rent, which means that a measure of monthly cost based on the solely housing unit value would be highly suspect and could undermine the credibility of the system.

Thus, for Household Indicators to include measures of housing affordability that account for housing characteristics and monthly costs, UrbanSim's underlying models must also account for these variables. I am taking the approach of designing prototype interfaces for the indicators that I believe would be most helpful to users of Household Indicators, even though UrbanSim is not yet able to produce the required data. After testing these indicators with citizens, they can be used to guide further development of UrbanSim's housing models. In this way, developing interfaces for a new group of stakeholders may influence the underlying abstractions of the simulation.

Conclusion

A natural question for any citizen learning about a new government policy is, "How will this affect me?" Household Indicators will tailor UrbanSim results to show how policy decisions could affect the user's own household. Using personal information provided by the user, this web application will address questions about different future scenarios, such as, "Where could I afford to live?" "How long will it take me to get to work?" and "Could my teenager find a job near home?"

Initial user study results support the hypothesis that Household Indicators will be more readily understood by citizens than the existing indicators, because they can be more directly compared to citizens' ordinary experiences. In fact, user studies have already resulted in a push for greater realism in Household Indicators. In turn, the goal of providing information that is meaningful to citizens may require substantial changes to UrbanSim's underlying abstractions. The general lesson is that presenting simulation results to stakeholders with different expertise may require fundamental changes to the model itself.

Household Indicators addresses the further goal of engaging citizens in the urban planning process. Design decisions to achieve this goal include the use of a household profile to provide a sense of identity as one views the indicators, and the use of questions for each indicator to engage users in thinking about how decisions will impact their own households.

The next steps include development of further indicators, completion of the prototype, and evaluation of the interface with respect to the two primary design goals and several secondary goals such as transparency. Future work involves the development of new model abstractions and of new visualizations of model output intended for use by citizens.

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