Household Indicators: Design to Inform and Engage Citizens

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Abstract
Urban simulation systems can be a powerful tool for helping to understand the complex, long-term consequences of urban planning 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, urban simulation, multidisciplinary design/interdisciplinary design, 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, 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 [6].

In urban planning, indicators [2] are often used to monitor changes in a region with respect to specific attributes of concern. Indicators such as population density 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.

Household Indicators are a new approach for allowing citizens to interact with UrbanSim results. 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 policy decisions will have long-term impacts on their own lives—in effect, by addressing the question, "How will this decision affect me?"

This extended abstract presents work in progress on the design of Household Indicators. In the next section, we explain the theoretical framework for the design of Household Indicators. Then, we discuss design process and rationale, focusing on design decisions relevant to the design goals of informing and engaging citizens. Finally, we conclude with lessons learned and future work.

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 [3]. A 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.

In applying Value Sensitive Design to UrbanSim, we have carefully distinguished 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.

Furthermore, to be an effective part of a democratic planning process, the use of UrbanSim should be seen as legitimate by the range of stakeholders. In earlier work [1], we drew on Habermas's concepts of legitimation potential and communicative action [4] to derive several testable design goals in support of UrbanSim's legitimacy: 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 aimed to provide comprehensible, accurate, transparent, useful, and relatively neutral technical information to urban planners [1]. By contrast, work on Household Indicators focuses on providing information that is comprehensible to citizens and clearly 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 particular, the commitment to accuracy requires that we not oversimplify the world or the simulation models to present information that is more easily understood. The commitment to transparency presents the challenge of providing explanations of simulation results that are ready-to-hand when questions arise.

Designing Household Indicators

After the initial conceptualization, design activities continued with semi-structured interviews of nine Seattle citizens (4 women, 5 men) ranging in age from 31 to 49 (M = 36). These interviews were intended primarily to assess the viability of the concept and to determine which potential indicators are of interest. Following this initial exploration, we developed a series of paper prototypes, focusing on a small number of indicators in which interview participants expressed interest and that UrbanSim could easily produce. Six Seattle citizens (3 women, 3 men) ranging in age from 32 to 53 (M = 43.5) participated in formative 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 shown in Figure 1.

The remainder of this section presents design rationale relating to the two major design goals: engaging and informing.

Designing to Engage

During the paper prototyping phase, two different interaction patterns emerged: one taking an exploratory approach to viewing Household Indicators (inspired by dynamic queries [5]), and the other allowing 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 is easy to explore implications for other households or hypothetical changes to one's own household.

The introductory screen provides a guide to using Household Indicators, including the three steps to create a household profile and an estimate of the time required.

- Step 1: Enter some basic information about your household. (<1 minute)
- Step 2: Where are your places? (2-3 minutes)
- Step 3: When and how do you travel between these places? (2-3 minutes)

The first step of creating a household profile lets the user specify a name, income, and home location. A callout explains why the user should provide this information, giving examples.

The following two steps let the user describe places and trips among them.

Why? Providing this information lets you create multiple household profiles with different names. You can explore what it would cost to live in different places. (See example) You can also learn information about your own neighborhood. (See example)

Each indicator includes questions that it can address. This indicator display lets the user compare travel times for several trips across different future scenarios.

View alternative futures for the Smiths:

Travel Times
How might your time spent on the road change over the next few decades?

Access to Jobs
If you were looking for a new job, could you find one close to your home? Would your teenager need a car to have a part-time job?

Average Neighborhood Home Price
How might the average price of homes in your neighborhood change?

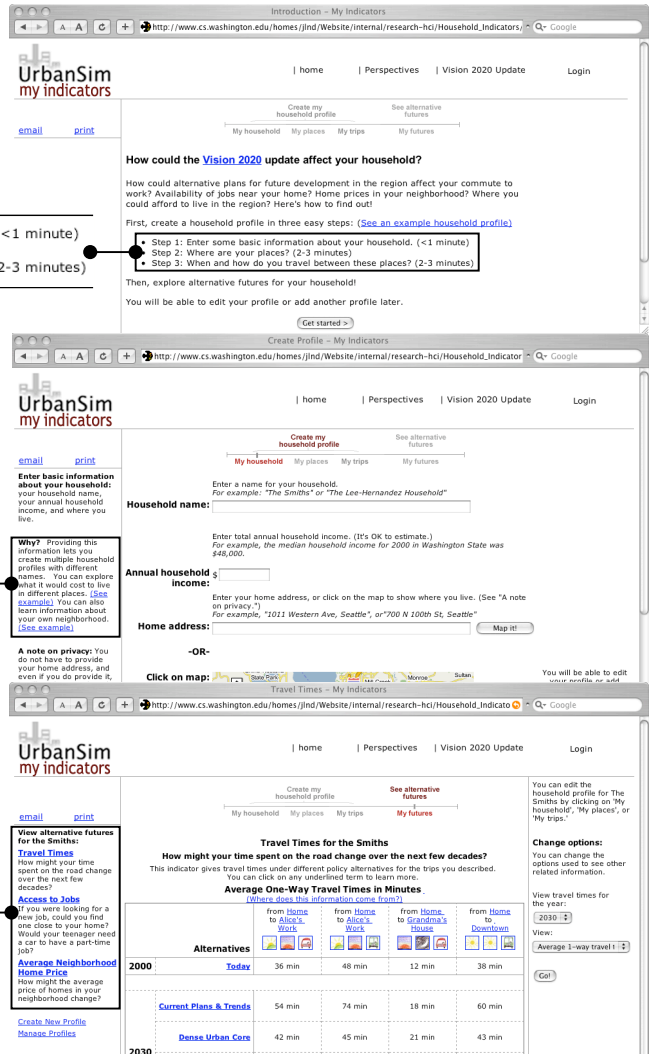

Figure 1. The web prototype of Household Indicators lets the user create a household profile and then view indicators that are tailored for their own household.

However, one of the key goals for the system is to engage citizens through the question, "How will this decision affect *me*?" This emphasizes exploring information relevant to user's *own* household. The household profile, which may bear the family name(s) of the user's own household, fosters a sense of identity that persists while viewing different indicators. Therefore, we have chosen to take the household profile approach. Concerns about the time required to set up the profile are addressed by giving estimates of the time required 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, helping the user explore changes to their household, such as moving to a new neighborhood.

An indicator must be an indicator *for* something that is of concern to the stakeholders. In the paper prototypes, each indicator included 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 in the prototype did not address the question given in the user study task. In more recent prototypes, 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 car 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 help the designer ensure the information is relevant and accurately represented. For example, once we assigned to the "Housing Affordability" indicator the question "How might the average price of homes in your neighborhood change?" we realized we should also change its title to the more accurate "Average Neighborhood Home Price."

Designing to Inform

In designing to inform, the central hypothesis is that Household Indicators will be easier for citizens to comprehend because they present simulation results in familiar terms. Early user study results and informal feedback support this hypothesis; indeed, there has been a push for greater realism and detail in reporting Household Indicator.

One case is concerned with indicators of travel time between different places by various modes of transit (auto, public transit, walking, etc.). In the paper prototypes, an indicator titled "Commute Times" showed the round-trip travel time from the user's home to work during peak travel times. Some user study participants found this indicator difficult to relate to—those who travel at non-peak times, from starting places other than home, or to destinations other than work. In response, we created a new "Travel Times" indicator, based on trip profiles that include not only a destination and a travel mode, but also a starting location and a time of day. Colleagues have also noted that a trip may include several stops along the way, for instance to buy coffee or drop a child off at day care, a phenomenon that transportation planners call *trip chaining*. Design of an interface that accounts for trip chaining is underway.

Another case is concerned with indicators of housing price. Currently, UrbanSim uses the *housing unit* as the abstraction of housing. A housing unit has a monetary value, an age, and so forth, but does not include characteristics such as number of bedrooms, whether it is attached to or detached from other units, or whether the occupants own or rent the unit. This abstraction is familiar to many urban planners, but not so familiar to those without training in urban planning. At first, we considered this a matter of transparency—carefully pointing out the differences between the housing unit abstraction and ordinary conceptions of housing. The user studies disabused us of this notion. It is difficult to know 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 the value into a monthly rent. A measure of monthly cost based on the existing 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. We are taking the approach of designing prototype interfaces for these indicators, even though UrbanSim is not yet able to produce the required data. After testing these interfaces 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 simulation abstractions.

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 comprehensible to citizens than the existing indicators, because they can be more directly compared to citizens' ordinary experiences. 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. To achieve this goal, we use a household profile to provide a sense of identity as one views the indicators. We also use questions for each indicator to engage users in thinking about how decisions will impact their own households.

Next steps include development of further indicators, completion of the prototype, and empirical 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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