DESIGNING & VISUALIZING
prototypes for making decisions in the face of uncertainty

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Model Citizens
Visualization, modeling, and simulation technologies are immersing stakeholders in the planning process.

By KEVIN C. DESOLZEA and KENDRA L. SMITH

May be the task ahead of you is as simple as working with community members to define a new park area or a residential area. (Okay, that should be simple—in theory.) Or maybe it’s as complex as siting a new factory with all its attendant social and environmental implications, in the middle of a large, densely populated city. You might even be on a team evaluating the impacts of a national decision on oil and gas exploration in Maine to foreign investors (more on that later). Regardless of the project scope, emerging information technologies—visualization, simulation, and modeling—are opening up new avenues for greater collaboration and citizen engagement in the planning process. These technologies allow users to conceptualize and weigh options on urban issues in a data-driven way—yielding both accuracy and efficiency. The end result is more informed decision making.

When the vast amounts of data collected—from sensors, cameras, satellites, images, and more—create opportunities for new modes of engagement. Take Chicago’s Woolsey project. It’s a real-time geographic database that houses about 600 databases from nine sources as the 911 and 811 services, building information, transit, and—importantly—public tweets, that gives access to real-time and historical data to help leaders gauge the overall health and function of the city. It can show sanitation, maintenance, and weather incident (think: storm damage) information, as well as highlight nonemergency events such as parades or sporting events.

Washington, D.C., provides another example. In 2014 officials offered three proposals for the elementary school boundary. The models would allow residents to see how each proposal affects current and future neighborhoods, as well as travel and safety challenges, but the proposals would also change the traditional school assignment method. The Washington Post developed an interactive map (http://washingtonpost.com/urban transcription) with data from the Office of the Deputy Mayor for Education to help parents understand the proposed zone changes—which would affect how students were assigned to schools—as well as the current middle and high school feeder patterns, options for replacing feeder patterns with lottery admissions, and options for attending schools other than a family’s neighborhood school. That data-driven approach provided early visualizations of how the proposed changes would impact neighborhoods. The technologies planners use today are sophisticated, but the idea of using visual technologies to solve challenging problems is not new. In 1864, Dr. John Snow used a dot map of cholera incidences by location in London that helped him discover that the disease was waterborne (caused by poor air quality) but also that the outbreak could be traced to a water supply contaminated with sewage. That discovery not only provided solutions to the acute problem, it also established the basic principles of public health that are still present today and eventually led to a future focus on water sanitation.

Today, we have opportunities to move beyond static engagement—where we present the stakeholder with finished drafts of plans, designs, models, or prototypes—to more dynamic engagement where stakeholders interact directly with our underlying data and models, allowing them to simulate for themselves various alternatives as they can understand the intended and unintended consequences of decisions. (For more on integrating data for planning, see “Data-Driven Planning,” Planning, April 2013.)

Visualization
In the busy world of urban planning, important information and data are getting buried in infographics and reports. When complex visual data tell stories more powerful and meaningful messages.

In 2011, the Guardian newspaper’s interactive team developed an interactive visualization thread (http://interactive guardian.co.microsoft) of tweets that proliferated during the UK riots that year. Unpublished stories about various occurrences throughout, and people took to social media to show support, opposition, or skepticism regarding a particular occurrence. The interactive team created visualizations that showed the tweets, information that was meaningful, and the associated sentiments, all of which were color-coded. Each cluster of colors—green, red, or gold—represented a specific tweet that was significantly mentioned and allowed them to follow a stream from its incep-
Infrastructure

Smart infrastructure innovations can improve a city's capacity to meet the needs of the public. Examples of smart infrastructure are roads that monitor how congested they are and where accidents are most likely to occur, and can adjust the recommended traffic speed accordingly; bus systems that can run different-sized buses at different times of day to meet demand changes; and energy grids that have better real-time and predictive features to meet demand. For instance, real-time and predictive parking reduces the frustration of residents and improves the quality of life. Sensors placed in the roadway identify whether a parking space is vacant and drivers can access this information via an app on their smartphone. This opens up the city for those who might otherwise avoid visiting for fear of not finding parking and increases accessibility to local merchants, which can boost the local economy. A reduced occurrence of “stuck in the traffic” to find a parking space reduces CO2 emissions, reduced traffic, and lower vehicle miles.

Smarter infrastructure has embedded information appliances which citizens can employ as they conduct their daily activities. An example of an information appliance that is embedding intelligence within a city is the next generation telephone booth created by Telcom Italia. The prototype was deployed in Turin, just outside the Turin Politecnico. The telephone booth can be used to make traditional phone calls, but it also allows users to find information about local attractions, shopping, public services, and even social networks. Visitors to Turin do not have to rely on static maps to navigate the city. Users can access information about real-time traffic conditions, location-specific, and real-time information. This technology is being implemented in other cities as well.

Another example of smart infrastructure is the development of smart grid systems. Smart grids use advanced metering infrastructure to improve energy efficiency and reliability. Smart grids allow utilities to monitor and control the flow of electricity, which helps to reduce energy waste and improve supply reliability. They also enable consumers to manage their energy usage more effectively, which can lead to cost savings and environmental benefits.

Predictive parking systems can help cities manage parking demand and reduce congestion by predicting where parking spaces will be available. These systems use data from sensors placed throughout the city to predict parking availability in real-time. This information can be shared with drivers through an app, allowing them to find parking spaces quickly and efficiently.

Overall, these smart infrastructure innovations provide significant benefits for residents and businesses alike, improving safety, reducing congestion, and enhancing the overall quality of life in cities.
Intelligent cities work creatively to ensure that their citizens enjoy a high standard of living. Critical to achieving this goal is the use of technologies to keep the city’s infrastructure up to date. This requires a city to consider not only its present but also what it wants as its future. Transitional states—cities that are undergoing a period of change—are viewed as experiment areas where feedback is sought from citizens.

Consider the case of Vienna. Vienna is consistently ranked as having one of the best standards of living anywhere in the world. By 2020 the city will have gone through a significant demographic shift from being one of the oldest regions in Austria to one of the youngest currently, just over 20 percent of all Viennese are under 30. In keeping with the demographic shift, Vienna is already making itself more accessible and friendly to the younger generation. The “Smart City Wien” project focuses primarily on developing models to promote intelligent urbanity with a focus on reducing the city’s impact on its environment and planning for rapidly changing population demographics. One major effort toward this goal is to make the city more bike-friendly.

The city government has committed Vienna to doubling cycling overall transport shares by 2020 from 5.5 percent to 10 percent. Vienna is focusing on creating “bike-friendly streets,” the upgrading of minor routes like the Rind-Ring-Radweg which has peak user volumes of over 750 cyclists per day. Further encouragement of cycling facilities (these are over 50,000 sites at the moment), and new solutions for the combination of cycling and public transport. Investments in cycle parking facilities, especially at subway stations, are also being made.

A critical aspect of maintaining high quality of life is ensuring that a city remains accessible to its residents and visitors. Today leads of cities when it comes to creating innovative solutions to combat high real-estate prices. As with most cities, real estate is expensive in “core,” which makes it inaccessible to the average citizen or tourist. Hites are therefore experimenting with offering capsule-style accommodation. A traditional hotel room in Tokyo will run you about ¥3150 a night. A tiny, tiny, room, for about ¥395 a night, you can rent a capsule with a bed, a small TV, Wi-Fi, an alarm clock, and programmable lighting that shifts with one’s circadian rhythms. A traditional hotel room will accommodate about eight guests.

Community facilities are provided for showers and luggage storage. These capsules are increasing in popularity as they provide a means to increase access to the city.

The Digital City

Vienna’s city authorities are improving the design, development, and operation of the city. Vienna is taking advantage of the quality order for its citizens by making significant improvements in terms of energy and mobility improvements.
CORE COMPETENCIES
Complex Systems Framework
Geographic Information Systems
Advanced Computation

Recent server addition added:
- 128GB Ram
- 300TB storage
- 256 virtual processing cores
NETWORK & HARDWARE
High Speed Network
Technology Infrastructure
ASU Data Centers
Server & Application Virtualization
Virtualization Systems
Collaboration & Visualization Environments
Interfaces
Telepresence Systems
High-performance Hypervisors and SAN
VM Servers
Rack Hardware
HID
Screens
Control
Tablets
Cellphones
Computers
CISCO
Workstations
ILLUSTRATIVE PROJECTS
The Arizona Budget Analysis Tool (AzBAT)  

**Challenge**
Enable lawmakers, economists, and the layperson to better understand the implications of the state’s budgetary changes.

**Solution**
A Budget Analysis Tool that shows implication of minor changes on different aspects of employment, education, tax rates, national standing of the state, etc. as well as its comparison with the history of budgetary changes in the state.
Challenge
Optimize energy investments and promote long-term prosperity.

Solution
A holistic model for real-time simulation of various investment scenarios, and their impact on socioeconomic variables such as GDP, job creation, and tax revenue.

Result
Decision Theater has built a strong relationship with Technológico de Monterrey, which recently constructed a 7-screen DT environment on site. Mexico's Minister of Energy has expressed interest in further collaborations.
Challenge
Improve fundraising efficiency by understanding factors that trigger/increase prospective donors’ propensity to give and the amount of donation.

Solution
A dashboard to visualize donor vs. non-donor groups and the programs donors support, preliminary data analysis to explore key indicators that could be used for donor profiles, and a statistical model to explain factors that help increase/decrease the amount of giving.

Finding
For those who donated $100,000+ in the past, total market value and the presence of children are two most statistically significant factors that influence the amount of giving.
Challenge
Understand Phoenix area residents’ and businesses’ concerns using survey data collected by Promise Arizona.

Solution
An interactive dashboard to visualize the survey results that helps community stakeholders make decisions on improving the standard of living.
**Challenge**
Analyze social media chatter during the FIFA World Cup 2014 to determine interesting aspects of online conversations.

**Solution**
Construction of a social data pipeline that can quickly and efficiently analyze and visualize large data sets.
LESSONS LEARNED
1: Start with the Goal in Mind

evidence-based decision-making
2: Explore Design Options

designing for the customer vs. designing with the customer
3: Small, Medium...Big Data

synthetic data fusing techniques
4: Rapid Prototype Dev.  
*open and frugal innovation*
5: Manage Scope Creep

bound the problem and hold
6: Review Sessions

be prepared for anything
7: Release in Beta

no such thing as a completed system
8: Promote Intrapreneurship

develop competencies from within and promote innovation
9: Outputs & Outcomes

communicate scientific and business ROIs
10: Leadership Succession

* think ahead and build a plan*
Questions or Comments

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