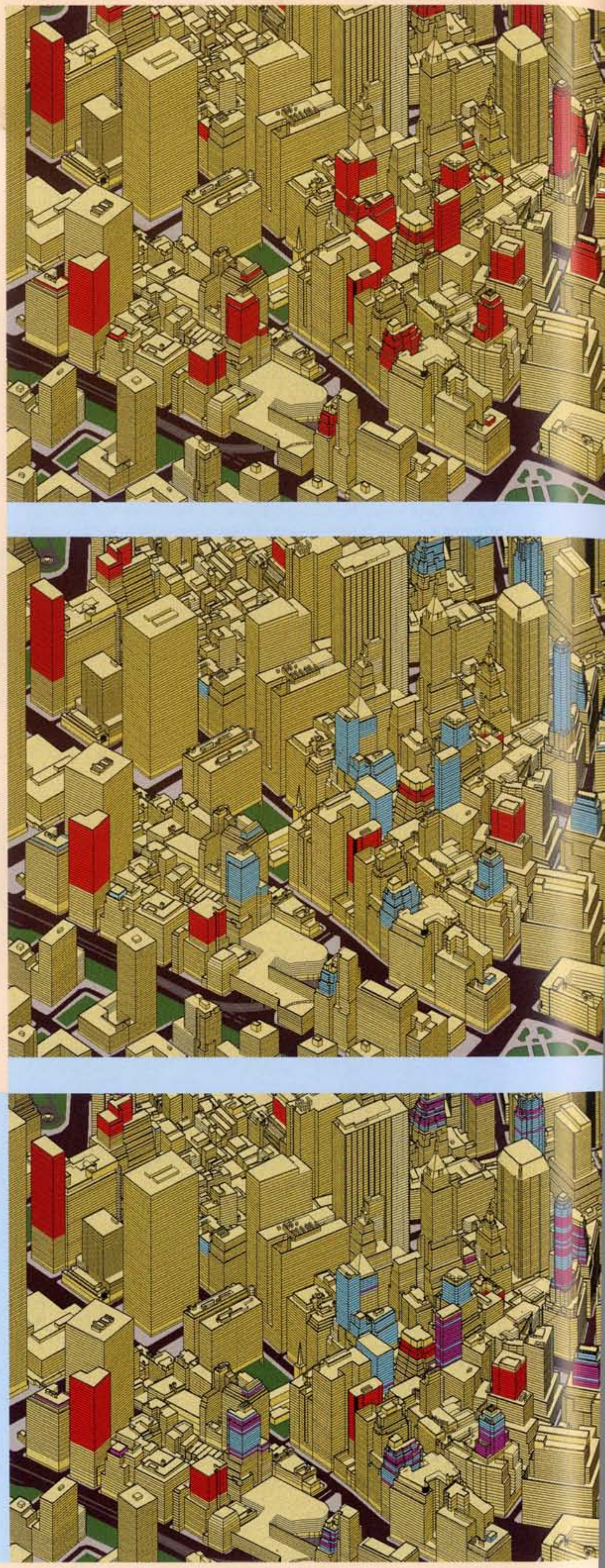
JUST-IN-TIME PLANNING: NEW YORK + HOUSTON

Michael Kwartler counters the rigid determinism of urban planning policy with a just-in-time approach. He describes a new planning, design and regulatory model that harnesses information technologies, such as geographic information systems (GIS) and emerging planning and design-decision support (PDDS), which 'learn' from experience and provide the means to be self-organising and adjusting, responding to rather than anticipating or even trying to direct change.

Planning for adaptive reuse in Lower Manhattan using 3-D-GIS
In 1992, the Environmental Simulation Center developed a 3-D-GIS system to examine the adaptive reuse potential of over 25 million square feet of vacant space in office buildings in New York's Lower Manhattan. 3-D-GIS spatially references the database to a floor-by-floor model of every building in Lower Manhattan, thereby enabling the user to capture, query and visualise data on a floor-by-floor basis that made it possible to conceptualise mixing uses at a fine grain, building by building. The database includes zoning, census, infrastructure, building construction and age, floor sizes and total floor area, independent elevator banks and vacancy rates that were updated quarterly. The figures here illustrate a sequential query with the top figure showing all floors above 150 feet that met the criteria for residential reuse, in red; the middle figure showing only those floors in buildings built prior to 1945, in blue; and the bottom figure showing all of the floors in the pre-1945 buildings that were over 50 per cent vacant at that time, in magenta. Beyond the individual building, the 3D-GIS made it possible to understand the probability of adaptive reuse in an area, and whether the aggregate of the floors converted to residential use achieved a critical mass for services and subway stations to be opened at night.



Planners and architects pride themselves on their (mistaken) belief that they can create regulatory regimes that reflect with certainty how citizens will live, work and recreate in the foreseeable future. The result has been highly prescriptive regulations, such as New Urbanist codes, that predetermine, on a site-by-site basis, where activities will happen, the intensity or density of the activities, and overdetermined building form regulations.

This approach to city design defies common sense when the perception, if not the reality, of cities is that they are chaotic and unpredictable entities. In other words, cities are examples of complex systems that manifest self-organising and self-adjusting characteristics. As Kevin Lynch has noted:

[the city] is the product of many builders who are constantly modifying the structure for reasons of their own. While it may be stable in general outlines for sometime, it is ever changing in detail. Only partial control can be exercised over its growth and form. There is no final result, only a continuous succession of phases.[1]

If Lynch's observation is true – and everyday experience tends to bear it out – then the current practice of planning, designing and regulating our cities is distinctly 19th century, where the factory system is applied to city design. In this system, cities are atomised into their component parts, optimised and reassembled into a rationalised whole.

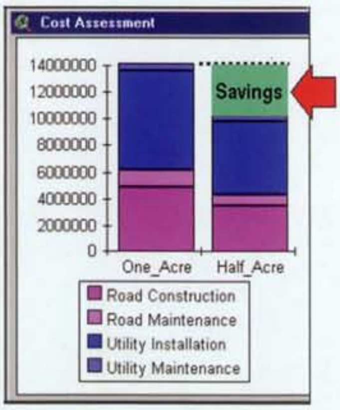
More recently we have begun to see planning, design and regulatory approaches that are decidedly more 21st century: approaches to city planning and design and regulation that are dynamic, that embrace complexity and change, and deal with flows

3-D-GIS of Lower Manhattan illustrating the information, query, and display capabilities of the database
The top two displays are quadrant axonometric views of the 3-D model. Top left displays all the buildings constructed between 1916 – when New York City adopted zoning – and 1945. Top right displays the degree to which all the buildings in Lower Manhattan are either overbuilt, underbuilt or built-out under current zoning, and is used to identify 'soft' or potential redevelopment sites and assemblages by the degree that the site(s) is underbuilt. Bottom left displays a Nolli-type figure-ground planimetric map with buildings shown in black and the spaces between them in white (the Nolli figure-ground map of Rome dates from the late 17th century and was one of the first of its kind to show accurate spatial relationships). The same device is used here to understand the 3-D spatial relationship of buildings in a high-rise district by literally slicing through buildings in 100-foot increments up to heights exceeding 1,000 feet. This display shows buildings and the space around them (including the roofs of lower buildings) at 200 feet. Bottom right displays a composite view showing an aerial perspective of Lower Manhattan and a single block, shown in the insets as an axonometric view and a portion of the block's database.

Visualisation can be tied to GIS data ...

... new policies can be proposed ...
... alternative scenarios can be constructed in three dimensions ...

... the impacts can be quickly identified ...



... and everything can be viewed and modified instantly in an interactive, virtual model of the community.

Community Viz™ planning and design-decision support software
Community Viz™, designed by the Environmental Simulation Center and its collaborators, is a suite of GIS-based PDDS software designed for planners, designers and communities that makes all types of data associated with planning and urban design issues – words, numbers and images – mutually accountable to each other in an intuitive, interactive and visual environment that facilitates the creation, comparison and evaluation of alternative scenarios and strategies. The process of using Community Viz™ is neither linear nor hierarchical. It has been designed to encourage the user to simultaneously test and evaluate the implications of scenarios at different scales, as well as develop and revise all assumptions, performance indicators and formulae in an accessible, fully transparent environment.

of information in iterative feedback loops. These feedback loops – with feedback beginning to occur in real time – make possible a fundamental change in thinking about planning and regulation, where demand (bottom-up) rather than supply (top-down) is the operative principle. Information technology is making these changes possible. Geographic information systems (GIS), whereby information is place-based, and emerging planning and design-decision support (PDDS) software, provide tools that enable cities and their citizens to be responsive to changing conditions and demands on how urban space is to be used and configured.

The state of the contemporary city argues for a method of planning, design and regulation that is 'just-in-time', rather than 'not-in-time' and 'just-in-case', while recognising that some elements in a city are more stable (for example, infrastructure, streets, blocks and plots) than others (such as buildings and how they are used). The metaphor for a Toyota-ist 'just-in-time' system could be the market. Indeed, Juval Portugali uses the food market as just such an example:

A miniature of the real big, large-scale case of just-in-time production and supply systems – the food market of large cities where a large number of firms of all sizes supply food for millions of people without creating shortages or surplus ... and what happens in the food markets is but one facet, indeed a beautiful illustration, of a more general property of the city as a self-organizing system.[2]

The key is timely information provided through feedback loops. This information is the 21st century's infrastructure equivalent of the 19th century's water supply systems and the 20th century's road and communications systems.

The planning, design and regulatory paradigm described here takes advantage of the accelerating feedback loops provided by GIS and PDDS, where information feedback on what is happening on the ground would be evaluated against expectation of performance. With the aid of GIS, performance becomes place-based, and plays a critical role in locating common ground. As Donald Appleyard has observed:

(T)echnical planning and environmental decisions are

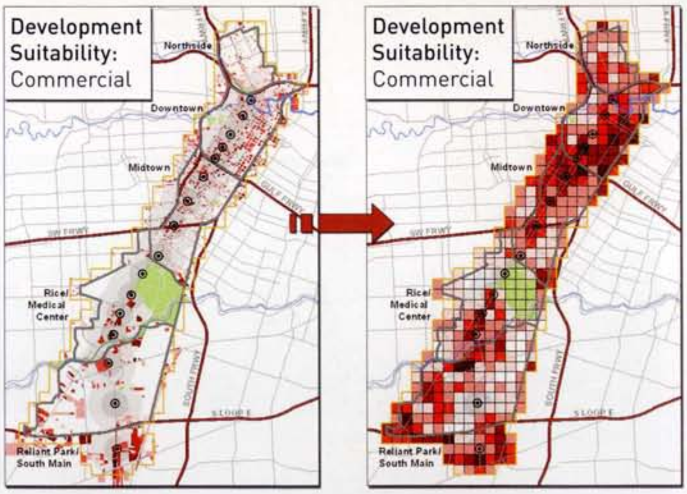
Technologically facilitated community-planning workshop
This series of images is taken from a community-planning workshop that used Community Viz™. The focus of the workshop was the urban regeneration of an obsolete industrial area. The workshop had three components: (1) formulation by the participants of indicators, bench marks and capacities that would be used to evaluate the performance of alternative urban-regeneration scenarios [right-hand columns of the user interfaces]; (2) the development of a 3-D tool box of smart, attributed neighbourhood 'building blocks'; (3) the design of alternative urban-regeneration scenarios in real time (lower map with dynamic view cone and above it the view of the interactive 3-D model at eye level). The sequence illustrates 'learning by doing', whereby the participants design a scenario in 3-D by selecting and placing the smart buildings in the model. Simultaneously, as the smart building blocks are placed in the 3-D model, the scenario's performance is evaluated against the indicators, which change as building blocks are added or subtracted, giving the designers immediate feedback on the implications of their decisions.

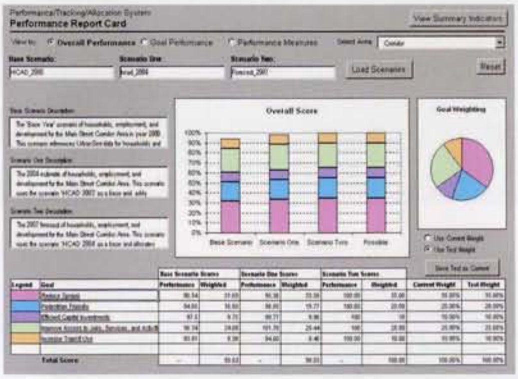
> not only value-based ... but identity-based ... (P)hysical planning decisions can, and frequently do, threaten the identity and status of certain groups while enlarging the powers of others.[3]

Performance indicators would be based on commonly held group values that by their nature are guiding principles and, hence, have a longer shelf life than the premeditated 'solutions' often embodied in plans and regulations, even including the more recent New Urbanist codes. Performance indicators are measurable using either qualitative or quantitative variables. An example of a performance indicator might be 'diversity' and might be measured by tenure, household income, age of the householder, along with other variables.

Unlike static systems, this new planning, design and regulatory paradigm 'learns' from experience and provides the means to be self-organising and self-adjusting, often resulting in a 'good' that could not have been anticipated in a top-down system. A metaphor would be the process in which moribund 19th- and early 20th-century industrial loft buildings and districts in Manhattan were illegally converted to live/work accommodation by artists and others. Facilitated by the fact that loft buildings are underdetermined and 'loose fit', Lynch's 'builders' experimented with ways to adapt such lofts to the needs of living and working. This 'group learning' led to the development of a new housing type, the repositioning of industrial districts and lofts in the public's mind 20 years later as highly desirable places to live and work and, ultimately, their legalisation in the city's zoning resolution.

Based on this example, we can imagine a city design and regulatory system that encourages creativity – 'the good you can't think of' – by framing the problem to be solved, rather than prescribing the solution. For instance, a principle that guides design and regulatory decision making might be: encourage a diversity of ways to live and work that do not threaten the well-being of the inhabitants and their neighbours. The performance of proposed uses against this principle can be measured by indicators of performance. By definition performance assumes





Managing change along Houston's light-rail corridor
Developed for the City of Houston by the Environmental Simulation Center, the Performance/Tracking/Allocation (P/T/A) system monitors growth along the city's recently completed Main Street light-rail corridor. The goals were: (1) measure the performance of the corridor against 22 community-based indicators; (2) track change as it occurs; and (3) allocate future-year growth to where it is likely to occur. It consists of two components: the Land Development Model and the Performance Report Card. The Land Development Model produces its monthly estimates of population, housing units, households and employment by utilising digital information already recorded by the city in the form of building permits. Outputs from the Land Development Model allow the user to examine change for dozens of indicators. In the example opposite, the user can see the spatial distribution of building permits indicating higher than predicted housing activity, and the adjusted forecast. The short feedback loop is extremely useful in targeting the planning and allocation of resources for infrastructure improvements to complement and encourage private investment. The top-right example illustrates the suitability of commercial development at a parcel level based on frontage on busy streets, proximity to light rail, plot size and surrounding uses. The Land Development Model is linked to the Performance Report Card (above), which organises and evaluates the corridor's performance against expectations. Because the districts through which the light rail runs are quite diverse, each district may weight the indicators differently based on community values. Further, the interface allows the user to evaluate performance at multiple levels of geography – the entire corridor, any district or any light-rail station. Both the Land Development Model and Performance Report Card are completely transparent and adjustable by the user.

that there are multiple right answers to a design or planning problem and the degree of 'fit' (see Christopher Alexander's *Notes on the Syntheses of Form*)[4] is the measure of performance.

We can design software built on a GIS platform that incorporates the tools needed to support a just-in-time performance-based planning, design and regulatory regime. PDDS demystifies the intricate process of planning by recognising that words, numbers and images are all ways of representing the world around us. This premise allows us to create 'what-if' scenarios integrating impact analysis (a moment in time), performance evaluation and forecasting (change over time) in an interactive 3-D/virtual reality environment. These tools are designed to support both deductive (analytical) and inductive (intuitive) reasoning in a nonhierarchical, nonlinear structure that supports the way we think.

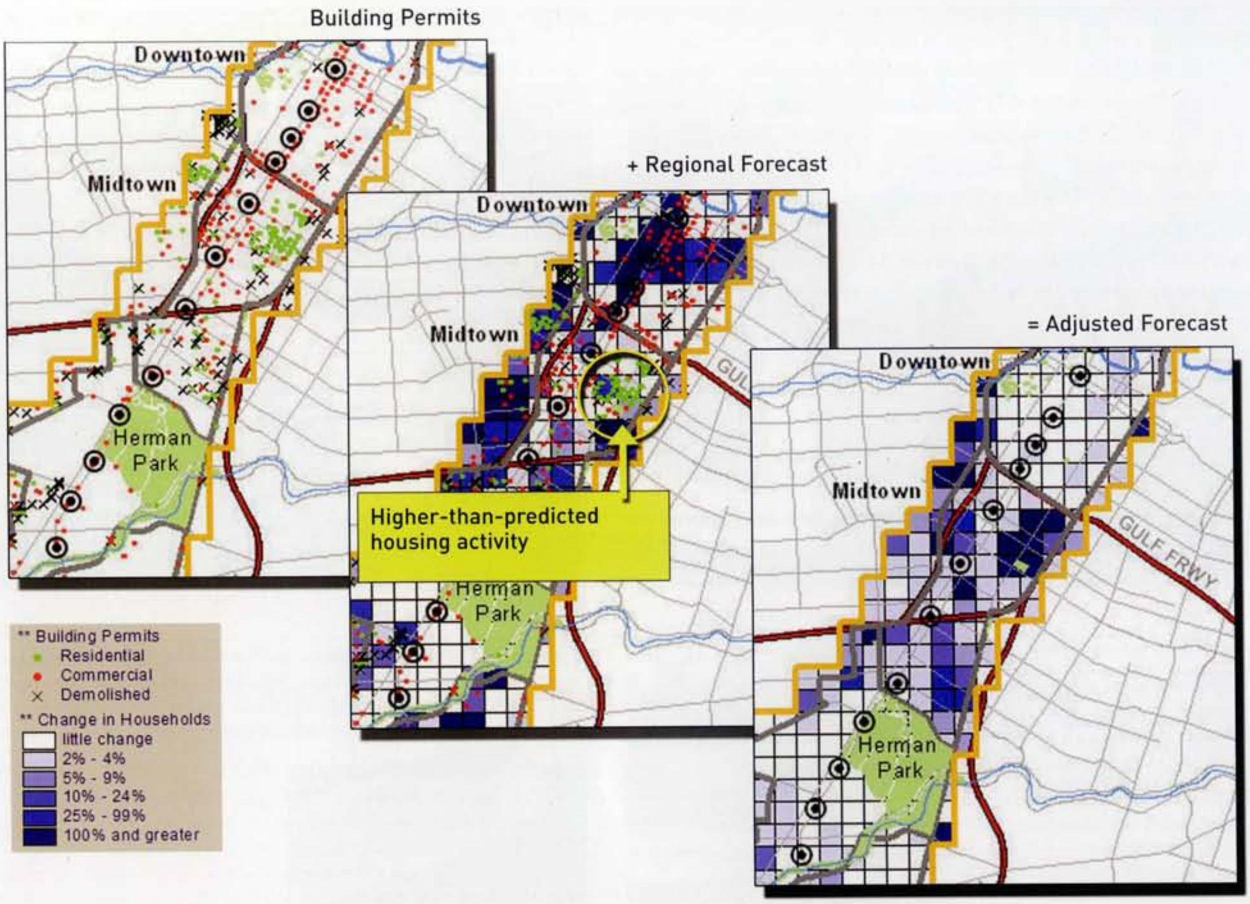
Most PDDS systems come with no data or formulae. Rather, they are empty shells that need to be populated with information about the community, by the community. The process of using PDDS does not require a specific entry point or order in which its component modules are used. For example, the user is not required to enter at the macroscale of public policy and work towards the micro-scale of neighbourhood block. Instead, the systems encourage the user to simultaneously test and evaluate the implications of a scenario at different scales, modify them on the fly, all in an iterative and interactive process that informs choices.

The principles and performance indicators described above must be formulated and weighted by citizens to ensure that they represent the community's values and sense of identity. This is a critical component of PDDS because it brings citizens together to determine the basis on which they will evaluate events, propositions and proposals, and make choices that are accountable to a shared set of values. A significant outcome of this activity is the creation of social capital.

The best PDDS systems allow everyone to participate in the process – even those who cannot draw or build models. For most citizens, the quality of the place is important, as it is what they experience. PDDS systems such as Community Viz™ enable citizens to approach issues experientially by testing ideas in three dimensions dynamically, greatly enhancing participation and levels of the playing field. In this modality, design itself becomes a form of enquiry.

Unlike conventional planning and regulation, which is episodic (for example, the plan and regulations are done once every 'x' years and then take on a 'mosaic' immutable quality), PDDS would be fully integrated into the public decision-making process to create scenarios, evaluate alternatives and provide the basis for informed public discussion and decision making. In communities, or even neighbourhoods, it is not unusual for the aggregates of incremental decisions, made over time, to lead to unintended and often unwanted consequences. PDDS can

P/T/A system: tracking change and allocating growth
The P/T/A system uses building permits to track change as it occurs and to adjust forecasted growth.



provide the forecasting environment that can suggest where the aggregation of incremental decisions may lead. For example, if we continue 'business-as-usual', what are the short-, medium- and long-term consequences of our actions, and are they acceptable based on our commonly held values and identity? Further, PDDS provides the environment in which to calibrate values and, when necessary, re-evaluate their relevance and their relative and absolute importance based on feedback from prior decisions and actions. A 'good thing' one day might be a 'bad thing' the next day and vice versa. An example of this could be the Eiffel Tower which, when it was built, was widely panned by artists and intellectuals, and only later became a structure revered by Parisians and an icon of the city.

Such tools have the potential to provide the substantive basis for decisions made at the appropriate level, decentralising decision making to those most familiar with the place, the issues and the information needed to inform the decision-making process. The metasystem of commonly held values, principles and performance indicators would be adjusted to local conditions. For example, the performance indicator that evaluates compliance with the diversity principle used above could be weighted differently among all the performance indicators, and the diversity 'mix' adjusted to local goals. The process of localising principles and performance indicators to a community is critical to the objective of building social capital through a reinvigorated concept of citizenship, and rejects the 'one-size-fits-all' approach to planning, design and regulation.

Finally, the devolution of control made possible by information technology helps to loosen the tight reins of overdetermined systems of control and exclusion into an underdetermined system of inclusion that harnesses responsible individual action and creativity, and sustains the creation of social capital and democratic values. Given the vested interests in the status quo at the national, and even the state, level the local level presents the ideal environment for creativity and democratic decision making based on inclusion and enlightened understanding, control of the agenda, effective participation, and voting equality at the decisive stage.[5] We should seize the moment. ⌂

Notes

1 Kevin Lynch, *Image of the City*, MIT Press (Cambridge, MA), 1960, p 2.

2 Juval Portugali, *Self Organization and the City*, Springer Verlag (Berlin Heidelberg, Germany), 2000, p 36.

3 Donald Appleyard, 'The Environment as Social Symbol', *Journal of the American Institute of Planners* 143, 1979.

4 Christopher Alexander, *Notes on the Synthesis of Form*, Harvard University Press (Cambridge, MA), 1966.

5 Robert A Dahl, *Democracy and Its Critics*, Yale University Press (New Haven, CT and London), 1989.