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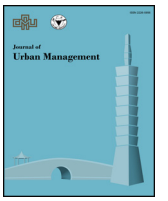

The ecological wisdom of plan-making☆

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A B S T R A C T

Most of humanity lives in urban regions. The number of people inhabiting cities is expected to continue to grow through this century. As our species becomes more urban and increases our effects on the planet, our relationships with natural systems will continue to change. We need wisdom to adapt to changes in this new era, called the Anthropocene. Overarching challenges and questions include: Will we continue to deplete ecosystem services as we expand our urban footprints? Or, will we learn how to enhance and create ecosystem services through city planning and urban design? The planning process can help humanity to adapt to these challenges. Ecological knowledge can help inform and guide the planning process. Such a process might even produce wisdom through application and reflection. An example of the Austin, Texas (USA) comprehensive planning process is provided to illustrate the prospects.

Wisdom in the Anthropocene

How wise is our species? According to Seligman and Tierney (2017), Seligman, Railton, Baumeister, and Sripada (2016), the name of our species, *Homo sapiens* (from the Latin for "the wise man"), is a misnomer. They suggest renaming our species—*Homo prospectus*—to reflect our ability to contemplate the future. The imagination of possible futures involves planning. We are a planning species. This paper explains the planning process, and then offers an example.

Ecological knowledge can contribute much to the diagnosis of a place before a planning or design intervention is undertaken. Furthermore, plans work best when they are flexible and capable of dealing with uncertainty based on changing circumstances and imperfect information. From nature, we know that the species that survives is not always the strongest or the most intelligent. Rather, the species that is most adaptable to change has the advantage. Thankfully, we humans are an adaptive species, and design and planning are among our most powerful tools for adaptation and change.

Designers and planners think ahead to envision future possibilities for the places they work. The primary scales for design and planning—site, community, landscape, city, and region—suggest that urban planners and designers must deal with both close-knit groups and larger populations. Environmental and social concerns are equally important at all scales. Fry (2011) and Weber (2013) argue that humans need to pay attention to "being alive," underscoring that our lives are connected to larger systems, best understood at several scales. Like landscape architects and planners, ecologists also work at many scales, from specific sites to landscapes and even regions. As a result, urban nature needs to be considered across scales from the site to the region.

We now live in the Anthropocene, an era in which humans dominate fundamental biophysical conditions at the global scale, from the climate to the survival of other species. We have an abundance of information about our planet. However, we lack the ability—the wisdom—to apply that knowledge to produce positive change.

Ecology can be a useful tool for the future of our planet in the Anthropocene (Weller, Hoch, & Huang, 2017) through what has

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been called “Earth stewardship,” which the Ecological Society of America defines as “shaping trajectories of social-ecological change at local-to-global scales to enhance ecosystem resilience and human well-being” (esa.org). The ecosystem services concept can be helpful in this regard (Costanza et al., 2017). These services address the important benefits that humans and other species derive from healthy ecosystems. For urban ecology to be understood more fully and applied more effectively in landscape architecture and civic design, an understanding of the process used in site and city planning is necessary. This process involves setting goals, assessing the environment, analyzing suitabilities, exploring options, selecting a course of action, seeking and securing funding, testing those actions through design, implementing a plan and design, and monitoring performance (Steiner, 2011, 2018).

Planners seek to design and plan for the uses of the land and thereby create better places and habitats in which people and other species can live and prosper. An understanding of the ecologies of urban plants and animals is especially useful in this regard. Along these lines, several scholars have advocated for “biophilic cities,” in which the welfare of nature and other species is regarded by people as essential for happy, healthy, and meaningful lives in such cities (Beatley, 2010).

A landscape is the synthesis of the natural and social phenomena that comprise a place, including its economic and political dimensions. We can understand our communities and regions by learning to read landscapes. Ecology is now seen as a core science that enhances landscape readings in two primary ways: first, ecology can advance our individual and collective literacy about natural and human behavior as revealed on the land, and, second, ecology involves the exploration and unraveling of the natural relationships between all organisms, including humans, with their respective environments. By extension, human ecology has equally far-reaching consequences. As Pope Francis observed in 2015, “Human ecology is inseparable from the notion of common good, a central and underlying principle of social ethics”.

Through reading landscapes not just culturally but ecologically, we can discover that some places are better suited for specific uses than others, and some places are downright dangerous. For instance, we know that floodplains are prone to fill with water, at times quite rapidly. If we allow houses, schools, towns, resorts, or industries to locate (and relocate) in flood-prone places, people and economies are put in harm’s way, yet we continue the practice. In addition to putting humans in danger, such development often destroys the riparian habitats of other species. Likewise, earthquakes can injure and kill people and result in extensive damage to property. Common sense suggests that a known and active fault zone is an unwise location for a nuclear power plant, yet worldwide we have located some nuclear facilities on these high-risk areas. We have the knowledge to minimize harm by locating development away from floodplains, fault zones, and storm-surge areas. We can also design buildings and landscapes that limit structural damage and minimize risk to people and other life-forms.

Since McHarg (1969) called on us to “design with nature,” ecologists and other environmental scientists have contributed much to the inventory and analysis phases of the planning process, from the specific site to regional levels. The ability to gather scientific information about an environment and then to assess its opportunities and constraints has been significantly advanced through computer-based geographical information systems (GIS) technology. By these approaches, we know that many areas are suitable for several uses. Flat land not in a floodplain, for example, is often well suited for farming and urban development.

Most land-use and planning decisions are made by analyzing the various options that lie ahead, which may involve documenting, through various measures, the anticipated positive and negative impacts of each option (Palazzo & Steiner, 2011). For instance, more urban development usually results in additional infrastructure and public services; it also results in more hard, impervious surfaces. Such impervious surfaces increase stormwater runoff and flooding. These increases can be estimated for the land-use options under consideration. Meanwhile, such decisions are frequently made with little or no regard for the impact on plants and animals. Options can be developed to explicitly consider the impacts beyond people.

After preferred options are determined, including inaction, then objectives are established that outline the specific steps that need to be taken to accomplish the goals for the plan. If a community’s goal is to reduce the danger of floods, an objective may be to limit impervious surfaces to an appropriate level based on the regional hydrologic cycle for any new development. The establishment of objectives might involve resetting or revising goals. With goals and objectives in place, a specific course of action can be determined.

Next, that course is pursued. This might involve enacting a regulation (for instance, allowing no buildings in a floodplain) or designing a new park (for instance, retaining natural habitat in the floodplain) and securing the funds to pay for the new park (for instance, using a public-private partnership to generate the money to purchase property in the floodplain). The actions may be bold or modest. These measures can be informed through design experiments that explore the spatial consequences of actions; by analysis, such as the reading of landscape through ecological and cultural perspectives; and from short-term and long-term projections of the population, transportation, and other public-service demands and needs, and the economy.

Although such analysis is most helpful in the planning process, it is not by itself planning. On the other hand, designers and planners are primarily motivated by a desire to intervene positively in the world around them. Their central aim is to maximize the public good and to envision a better quality of life for a neighborhood, city, region, and, to some extent, the world. The best planners and landscape architects depend on the best and most reliable data available, but their ultimate goal is to apply that knowledge in practical and creative ways that inform their vision and inspire their designs and plans.

Planners and designers are trained to explore various options in all settings and to help resolve spatial conflicts. These processes involve weighing the benefits and costs associated with each option and taking account of the potential winners and losers, paying particular attention to the needs of socially vulnerable communities. While creativity is always an asset, and some aspects of the planning process are more of an art than a science, planning should be undertaken with a basic knowledge of law, precedent, design, geography, and history. Effective planners inevitably are those who are strong in both analysis and imagination.

As actions are taken to implement designs and plans and to achieve established goals and objectives, all concerned and affected need to remain flexible in order to adjust to inevitable change. For example, a dam or a diversion tunnel might alter a floodplain for a river or stream; as a result, a city or town may rethink where the best spots are for houses, businesses, greenways, and parks. Global

climate change is also affecting landscapes everywhere, as weather and temperature vary from historic norms, as biomes migrate toward the poles, as the ranges of the bumblebee and other creatures shrink, as fruit trees and plants flower unseasonably early, and so on. As long as plans and designs are time-sensitive and can adjust to changing natural and cultural/economic conditions, communities can better adapt. Sharing designs and plans is a key to helping a citizenry, especially those to be most affected, to visualize the consequences of change and the potential courses for adaptation over time.

Citizens need to be involved in making plans and creating designs. The public can, from the beginning, help set goals and objectives; share local knowledge of neighborhoods, communities, and landscapes; determine best uses and design options; select courses for moving forward; take actions; and project adjustments to changes. City plans and urban designs are, ultimately, political acts, and, as such, they require the involvement, intelligence, and ownership of the communities that are impacted. Increasing ecological literacy and an understanding of landscapes can help the public more effectively engage in the development of plans and designs. Ecological wisdom can also be useful for planners, designers, policy makers, and citizens to consider the longer term consequences of their actions.

An example: Austin, Texas (USA)

Austin, Texas, is one of the most rapidly growing cities in the United States (2016 population 947,890). The city and its surrounding region are expected to continue to grow through the twenty-first century. The location of the state capital and a large research university, Austin also houses many high-tech businesses and a robust music industry. The city has been an environmental leader and innovator, notably in the areas of water quality, green building, and habitat conservation. It has a less stellar record in suburban sprawl, traffic congestion and modern light-rail, and, historically, racial segregation.

In 2009, city leaders decided to embark on its first comprehensive plan since the landmark 1979 Austin Tomorrow plan (published in 1980). The city engaged Wallace Roberts & Todd (WRT) of Philadelphia to lead a team of consultants. As Wallace, McHarg, Roberts, and Todd, the firm had influenced the 1979 plan through its water quality plan for Lake Austin (1976). A citizens' advisory task force was organized to help guide and inform the process for the new city plan.

The city council set three "overarching goals" for the new plan: community engagement, sustainability, and implementation. The citizens advisory task force especially engaged in numerous activities involving the public (Steiner, 2018). Named "Imagine Austin," seven key principles and 23 objectives were set for the comprehensive plan after considerable public participation (Table 1). The citizens of Austin want their city to be more livable, natural and sustainable, creative, educated, prosperous, and mobile and interconnected. In addition, they seek a city that values and respects people. Reaching consensus on these principles and their associated objectives (goals) was not an easy matter. It involved considerable discussion and often heated debate—a deliberative process (Forester, 1999).

To translate these goals into actions, the planners needed to understand and to communicate the social and environmental processes at work. Like most places on the planet, Austin is well mapped. For instance, Fig. 1 illustrates the tree canopy in the city. During the 1970s, Austin helped advance Ian McHarg's ecological mapping approach (McHarg, 1969) through the Lake Austin Plan (Steiner, 2011; Wallace, McHarg, Roberts, and Todd 1976). McHarg et al. employed several scientists knowledgeable about the region to generate maps and associated analysis. Now, GIS computer maps exist for practically every conceivable physical, biological, and social phenomenon and feature in the city. The GIS maps had been produced by various local, state, and federal agencies as well as non-governmental organizations and university researchers. This information was not employed in Image Austin in the 2010s with the same level of creativity as it had been in Austin Tomorrow in the 1970s.

The maps—hand-drawn and GIS—reveal Austin is well situated—geologically, hydrologically, and biologically—for human

Table 1
Imagine Austin principles and objectives.
Source: City of Austin (2012).

Desired characteristics of Austin	
Livable	**Prosperous**
• Healthy and safe communities	• Diverse business opportunities
• Housing diversity and affordability	• Technological innovation
• Access to community amenities	• Education/skills development
• Quality design/distinctive character	**Mobile and interconnected**
• Preservation of crucial resources	• Range of transportation options
Natural and sustainable	• Multimodal connectivity
• Sustainable, compact, and walkable development	• Accessible community centers
• Resource conservation/efficiency	**Values and respects people**
• Extensive green infrastructure	• Access to community services
Creative	• Employment and housing options
• Vibrant cultural events/programs	• Community/civic engagement
• Support for arts/cultural activities	• Responsive/accountable government
Educated	
• Learning opportunities for all ages	
• Community partnerships with schools	
• Relationships with higher learning	

Fig. 1. Austin, Texas tree canopy.
Source: the City of Austin (1980).

settlement (Steiner, 2011, 2018; Wallace et al., 1976). On its west, a vast, rich aquifer is the source of abundant clean water. On its east, productive soils are prime for farming and ranching. The hilly west is blanketed with majestic live oaks; the flatter, rolling prairies are crisscrossed by rivers and creeks. The challenge, of course, is how to protect this natural bounty in the face of rapid growth. The maps also illustrated different access to natural elements and open space among various social groups. For instance, the map showing tree canopy shows more trees in the affluent western portion of the city and fewer trees on the east side where incomes are lower (Fig. 1).

The landscapes present both opportunities and constraints. In the 1970s, McHarg's team revealed areas in the west of central Austin for conservation and development through suitability analysis. Such analysis clearly involves ecological wisdom. Austin Tomorrow extended this approach to the whole city and adjacent areas. This plan helped direct metropolitan growth with mixed results for several decades. Imagine Austin utilized a "greenprint" for Travis County (where Austin is located) produced by the Trust for Public Land and others to help determine constraints for development and opportunities for open space (Fig. 2). Constraints include aquifer recharge areas, important wildlife habitat, and places prone to flooding. Flash flooding makes some areas especially risky to locate housing, for example.

These suitabilities contributed to options for Austin's future, which prompted even more discussion and debate about equity, the environment, and the economy. The principal strategy to manage growth was to concentrate new development and redevelopment in centers: regional centers, town centers, neighborhood centers, and activity centers for redevelopment in sensitive environmental

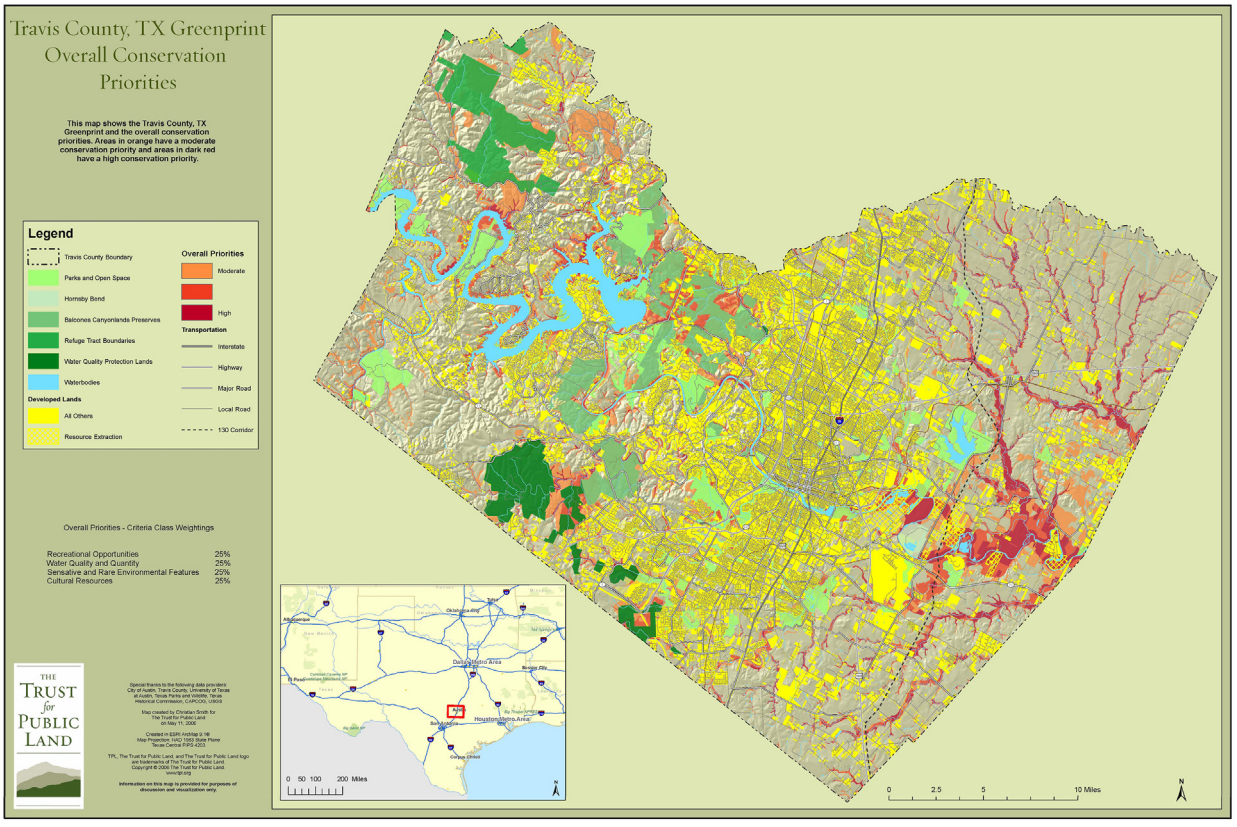

Fig. 2. Travis County, Texas Greenprint.
Source: Trust for Public Land.

areas (City of Austin, 2012). The centers over the environmentally sensitive areas (mostly aquifer recharge zones) were controversial but also fair. Unlike past plans, considerable efforts were made to create opportunities for more parks and open space (primarily floodplains and prime farmlands) in the poorer, historically minority eastern portions of the city. While some job growth in the western environmentally sensitive areas was contemplated, there were also regulations to protect the aquifer and important habitat. The overall objectives were to make the city more compact and better connected. Improved connectivity involves less dependence on automobiles, more public transit, and improved pedestrian and bicycle facilities.

In places with environmental impact review authority, comprehensive impact statements can be used to help guide the configuration of such centers and their subsequent realization to avoid negative repercussions. Such authority does not exist in Texas beyond the environmental impact statement requirement for federal projects. The national law can apply to federally funded transportation projects.

Plans are only successful if they lead to action. Following the adoption of the Imagine Austin comprehensive plan by city council in June 2012, implementation began with mixed results. A light-rail line was defeated by the voters in 2014. The line would have significantly improved connectivity. A rewrite of the city's development code to bring it in line with Imagine Austin began but took longer and cost more than anticipated. Annual reports assess progress through key, measurable indicators, such as the amount of parks and open space. Overall, green infrastructure, such as the Waller Creek Corridor in central Austin, is expanding. Green infrastructure has been advanced by the US Environmental Protection Agency and others as a strategy to enhance ecosystem services through multifunctional open-space systems. The region experiences periods of drought interrupted by intense, often dangerous, flooding. The weather extremes are becoming more dramatic. As a result, green infrastructure can help the city and its region adapt to climate change.

Successful plans adjust to change. Imagine Austin built in an adjustment device with annual progress reports and a more comprehensive review after five years. The five-year report provides an in-depth analysis of complete communities indicators (Table 2). These indicators provide the framework for a comprehensive assessment with specific metrics to gauge progress. Essentially, the city decided to rate itself with specific performance criteria. This approach contrasts with the often-arbitrary rankings of outside groups. Down-to-earth factors would be assessed, such as residents who are overweight, impervious cover, water quality, live music venues, bicycle miles traveled, and new businesses started per capita. Programs are grouped in topic areas, including "Natural and Sustainable", focusing on sustaining water supplies and creating green infrastructure. Performance and improvement can be assessed by city planners and elected officials year to year and over a five-year period. These assessments will be available to the public to gauge

Table 2
Complete communities indicators.
Source: City of Austin (1980).

Livable
Households with children (tracked geographically)
Residential density (people per square mile)
Median housing values (dollars, by zip code)
Median rent (dollars, by zip code)
Cost-burdened households (housing, transportation, and utility costs)
Residents who are overweight/Obese (percentage)
Community gardens/plots/local farms (count and acreage)
City wide crime rates
Perception of safety (community survey)
Homeless count (annual point in time estimate)
Number of farmer's markets, farm stands, and mobile healthy food carts
Households one-half mile (0.805 km) or less from full-service supermarkets/grocery stores (percentage)
Natural and sustainable
Developed land (square miles)
Mixed-use development (percentage)
Impervious cover (percentage per capita and total)
Parks and open space (acres/acres per capita)
Water consumption (total water use and per capita residential)
Water quality
Air quality (nitrogen oxides and volatile organic compounds)
Greenhouse gas emissions (by sector)
Energy generation, percentage of renewables
Development within the Edwards Aquifer recharge and contributing zones (square miles)
Development within the 100-year floodplain (square miles)
Households one-half mile (0.805 km) or less from a park or accessible open space (percentage)
Creative
Dedicated municipal funding for arts (dollars per capita)
Private funding for arts (dollars per capita)
Arts programs in schools and neighborhood recreation centers
Attendance at arts/cultural events
Money brought into economy from arts/cultural events
Live music venues
Households one-half mile (0.805 km) or less from an art/cultural venue (percentage)
Educated
School attendance rates
High school graduation rate (percent age, by geography)
Residents with undergraduate and graduate degrees (percentage)
Standardized test scores
Enrollment in certification, continuing education, and lifelong learning programs
Households one-half mile (0.805 km) or less from a library or community center.
Households one-half mile (0.805 km) or less from a school, public and/or private (percentage)
Mobile and interconnected
Transit ridership (percentage of trips)
Vehicle miles traveled (total and per capita)
Average transit headways (minutes)
Bicycle miles traveled (total and per capita)
Sidewalks (linear miles and percentage of street frontages with sidewalks)
Bicycle lanes (linear miles)
Households one-quarter mile (0.402 km) or less from an urban trail (percentage)
Households one-quarter and one-half mile (0.402 and 0.805 km) or less from transit and high-capacity transit (percentage)
Employees one-quarter and one-half mile (0.402 and 0.805 km) or less from transit and high-capacity transit
Prosperous
Employment density (jobs per square mile)
Economic output (dollars)
Job/housing balance (ratio of jobs to people)
Employment rate (percent)
Tax revenue (dollars)
New businesses started per capita (dbas flied per capita)
Households one-half mile (0.805 km) or less from retail and mixed-use centers (percentage)
A Community that values and respects people
Public safety response times (minutes)
Voting rates (tracked geographically)
Proportionally of arrest demographics (yes/no)
Households one-half mile (0.805 km) or less from medical services (percentage)

the performance of Imagine Austin and to make necessary amendments.

This approach is innovative and presents many good prospects for the citizens of Austin. For example, the Natural and Sustainable Indicators reflect an emphasis on green infrastructure, a concept that appears often in Imagine Austin. A leader of the WRT team, David Rouse, is the coauthor of an important green infrastructure book (Rouse & Bunster-Ossa, 2013) and his expertise on the topic is evident in the plan. As noted, this concept is a potentially significant lasting legacy of the plan.

Conclusions

Ecologically based designs and plans lead to healthier, safer, and more beautiful and sustainable places for people and other species (Steiner, Thompson, & Carbonell, 2016). Ecological plans and designs can augment places so they become more just and often more profitable, so they help sustain and enhance what we value, helping transcend the inherent worth of sustainability by creating truly regenerative communities. An understanding and appreciation of nature can provide a valuable and fundamental base of knowledge for plans and designs that can elevate living organisms of all kinds, as we learn how to relate better to one another in our communities and cities and shared Earth. As a start, the ecosystem-services concept provides a useful framework to assess the consequences of city and regional plans on the environment, socioeconomics, and public health, safety, and welfare.

There is an ongoing need for change in urban design and planning theory and practice so they reflect current needs and aspirations. Ecological literacy for those involved in the planning and design processes is an essential base for any design or plan to be relevant in today's world. Landscape architects and planners need the wisdom to link ecological information to actions across many scales, communities, and regions. Already there is ample information about how natural environments of every kind operate, but decision makers need to embrace that knowledge more fully and use it more wisely when taking action.

In his insightful article "Reading through a Plan," Brent Ryan observes, "plans continue to constitute the major printed currency of the planning profession, perhaps because the public continues to see plans as meaningful expressions of future intentions for a place" (Ryan, 2011, 309). Furthermore, Ryan (2011, 309) contends that "generating plans is perhaps the central creative act of the planning profession", and, drawing on Michael Neuman, that plan-making is the act which "gave planning its name" (Neuman, 1998, 216). The process leading to the creation of a plan can help us understand what Ryan calls their factual meaning, contextual meaning, and temporal meaning.

We understand—we learn—both by doing, that is, by making plans, and by reflecting (Schön, 1983) and by deliberating (Forester, 1999). Through experience, we develop a tool kit for future endeavors to help anticipate what kinds of facts are useful, to help read context, and to help value the time involved in the process. Experience should improve how we plan and design if we pause to reflect about what happened during the planning process. We learn through our successes and failures. We can also learn from the experiences of others and from past plans.

Note. This essay was adapted from the first chapter of Making Plans: How to Engage withLandscape, Design, and the Urban Environment (2018, University of Texas Press).

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