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RESEARCH ARTICLE

Urban greenways: Operationalizing design syntax and integrating mathematics and science in design



Archana Sharma*

Morgan State University School of Architecture and Planning, CBEIS, 1700 E. Cold Spring Lane, Baltimore, MD 21251, USA

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Abstract

The ubiquitous sameness of urban greenways prompts questions on generative design grammar and syntax, whether creative, critical rethinking at that level might be lacking. However the design syntax of urban greenways is not explicitly discussed thus leaving a critical gap in knowledge. This paper begins tackling the larger question by acting on the fundamental subset of it, by operationalizing the design syntax of urban greenways. This is done through mathematics-based graph studies to analyze patterns and shapes, photography based thermal, material and morphology studies, and section analyses to make imagery-derived deductions on the design syntax. Recommendation on approaches to diversify and enrich the design syntax includes a more direct reference from ecosystem science theories such for siting and planning the urban greenways at macro- to meso-scale, a mixed-method approach, combining mathematics, photography and drawings based frames for analyses at meso-, to micro-scale, and a turtle view scale for designing at meso- to micro-scale, with an emphasis on latter.

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1. Urban greenways

Greenways, also referred to as linear landscapes and landscape corridors in popular discourse, acquired a distinct

body of knowledge developed through key contributions of Little (1990, 1995), Fábos (1995), Fábos and Ahern (1996), Flink et al. (2001), Jongman and Pungetti (2004), Fábos (2004) and Hellmund and Smith (2006), over time. Little (1990, 1995) explained the idea of a greenway as a combination of greenbelt and parkway, to quote "...if you take a syllable from each of these terms - *green* from *greenbelt* and *way* from *parkway*, the general idea of

*Tel.: +1 443 885 1898; fax: +1 443 885 8233.

E-mail address: archsharma1@gmail.com

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greenway emerges: a natural, green way based on protected linear corridors which will improve environmental quality and provide for outdoor recreation (Little, 1995: 4).” The President’s Commission on Americans Outdoors (1987) envisioned “a Living Network of Greenways... to provide people with access to open spaces close to where they live, and to link together the rural and urban spaces in the American landscape... threading through cities and countrysides like a great circulating system.” Fábos (1995, 2004) emphasized that “greenways are ecologically significant corridors, recreational greenways and, or greenways with historical and cultural values” and thus advocated for greenway planning as a comprehensive multipurpose, multi-objective effort. Ndubisi et al. (1995) observed, that “environmentally sensitive areas when interconnected could serve as greenway corridors.” Ahern (1995) explained, “(that) greenways do not attempt to transform or control the entire landscape—but by focusing on riparian corridors and other environmentally sensitive areas, greenways are more modest in their ambitions, while exploiting selected linear elements in a strategic and synergistic manner.” My own research concurs with Ahern’s idea and defines greenways as “synergistic landscapes that create harmony amongst the urban system with broader biophysical system” (Sharma, 2010).

Many offshoots of the greenway concept have simultaneously emerged and thus led to confusion about the identity of greenways. In addressing this identity crisis, the comprehensive greenway nomenclature by Hellmund and Smith (2006: 2) is reviewed and reinterpreted here to highlight the following definitive and distinctive features:

- Greenways are multipurpose connections that are mostly paved and allow for bike transportation.
- Complete streets and living streets are multipurpose transportation corridors; however, complete streets have vegetated shoulders and allow for automobile, bike, and pedestrian traffic, whereas living streets encourage pedestrian and bike traffic only.
- Green streets allow for multipurpose transportation, with emphasis on biking and a combination of private and public automotive transportation.
- Green trails are unpaved and mostly pedestrian connections.
- Green corridors and green infrastructure may or may not be paved and may or may not allow any form of transportation. The green infrastructure concept is said to be rooted in greenways (Benedict and McMahon, 2006) and has been considered a component of multiuse trails by some scholars (Flink et al., 2001: 15).

The current perception of or design attitude toward greenways, especially urban greenways, is that they are physical connectors between places with green cover. Lindsey et al. (2008) described greenways as linear open spaces or parks along rivers, streams, ridgelines, or historical infrastructure corridors, such as canals or railroads, with the potential to shape the urban form and connect people to places (53). Within this view of urban greenways,

the paper investigates the varieties of design approaches and language, currently being generated.

A critique of greenway design projects and proposals forms the foundation of this study, which synthesizes the urban greenway design syntax by using the basic principles of design, such as form, shape, material, and texture. A contemporary research method of graph analysis is then applied to the greenway design at the macro-scale to derive an understanding of patterns. Photographic appraisal is undertaken to extricate morphological details at the meso-scale, and analysis of section drawings is conducted to view the design details of urban greenways at the micro-scale. This study presents only one view on design, which is physical form oriented, but design can be discussed across multiple frames, such as sociology, philosophy, and economics, to mention a few. This investigation on design syntax does not present the breadth of discourse in this field because this is not the purpose of the current study. Instead, the investigation should be read as a complement to the broad contemporary discourse on the topic. The integration of science, mathematics and design is presented in terms of an experimental method.

2. Inquiry into design syntax of urban greenways

Syntax is mostly used in linguistics, but Hillier and Leaman (1974) reintroduced the concept to architecture and urban design through space syntax. Conceptualization of space syntax originated from questioning of critical thinking in design and most prevalently used to map and understand physical connectivity (Hillier and Leaman, 1974; Baran et al., 2008). Lynch (1960) offers a matrix for reading and assessing form. The matrix alludes to clarity in terms of figure background, contrast, and dominance; visible form or geometry, visual scope, and joints or nodes; and continuity, directionality, and motion awareness. This matrix serves as a structure for organizing forms, patterns and spaces to design a city (1960) and Alexander’s (1977) too for designing and retrofitting places, however, not a direct framework for design and planning of an urban greenway. The inquiry into design syntax, presented in this paper, considers previous studies on connectivity and syntactic investigations of Alexander (1977) and Lynch (1960), but focuses exclusively on understanding the design syntax of urban greenways. The paper uses the term “design syntax” to imply the composites of urban greenway with reference to the resultant spatial form. The intention is not to compare the design syntax with linguistics syntax as in this paper since that should follow this investigation in collaboration with a linguistic syntax expert, but to derive an operational understanding of design syntax first. Urban greenways, would be referred to as those designed primarily for humans; approaches that aim to reconcile the design for humans and other biodiversity are beyond the scope of this paper but are discussed in forthcoming text by Sharma (in press).

This section presents a review of urban greenway proposals and projects along the Appalachia to examine the current design syntax. Knoxville City in Tennessee claims to have 65.53 miles of paved and unpaved greenways in aggregation (City of Knoxville, 2012). The current plan is said to have coevolved

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