GENERATIVE DESIGN FOR A COMPLETE COMMUNITY PARK A WORK IN PROGRESS

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ABSTRACT

Complete communities and social cohesion are important considerations in urban planning. Generative design in complete community planning provides opportunities to further advance generative design technologies and effective integration of qualitative and quantitative metrics. It requires managing complexity on different scales, which is a challenge for traditional generative design approaches. We apply generative design to the planning of an urban park in a greenfield development. We entered the project when planning was underway, hence we tested generative design in a constrained design environment. This work-in-progress paper introduces the context of the project, the importance and contribution of this work, an overview of the methodology, and a discussion of the results for further development.

Keywords: complete community; social cohesion; park design

1 INTRODUCTION

Our work presents a case study in applying generative design in urban planning. We use generative design in designing a park for a new neighborhood located on a 20-acre site. The development and surrounding areas include diverse housing typologies, open green spaces, diverse amenities, and a commuter rail station, providing the neighborhood with many elements of a complete community. When we joined the project, some parts of the neighborhood were already planned but the park was still under design development.

Planning complete communities that meet the needs of diverse populations is interdisciplinary and highly complex. The process requires diverse expertise and navigation of tradeoffs between competing goals. This makes generative design worth exploring in planning complete communities. On the other hand, the mix of quantitative and qualitative objectives, the interdependence of these objectives, the real-world constraints posed by site conditions and planning practices, and the range of stakeholders that must be consulted makes urban planning a challenging context for generative design. Therefore, exploring the use of generative design in urban planning can yield important insights for the future development of both urban planning and generative design. Our contribution to generative design is innovative in three ways: 1) Applying generative design to holistic community planning is relatively new. 2) We address the complexity of quantitative and qualitative measures. 3) We tested generative design in a constrained design environment.

2 METHODOLOGY

We followed an iterative process of reviewing literature of complete communities and social cohesion, consulting experts and stakeholders, and following a generative design workflow. The workflow consisted of 1) gathering requirements and constraints; 2) defining project goals; 3) identifying metrics 4) building the model; 5) generating, evaluating, and evolving solutions; and 6) selecting and refining solutions.

Our generative design model was built to generate park layouts that fulfill the following objectives: 1) minimizing the distance traveled through park paths for pedestrians crossing the park from one housing area to another; 2) maximizing the distance between play areas and the main road; 3) facilitating frequent encounters between park visitors and facilitating parental supervision of play areas; 4) maintaining quiet zones by locating specific amenities far from play areas; 5) minimizing non-permeable ground cover; and 6) assigning sufficient square meters for each park amenity. Our model was built using Dynamo Sandbox. Two generators, one for the park paths and the other for the amenity areas, and six metrics associated with the previously outlined objectives were built into the model. Studies were run using Generative Design for Dynamo with the 'optimize' solver, and a population size of 500 over 10 generations. A visualization scheme was developed to compare the performance of generated results with the original park design.

3 RESULTS AND DISCUSSION

We selected six high performing solutions from the generative design study to refine and present. Since we used two separate generators, solutions needed to be refined to ensure amenities and paths were cohesively laid out. Figures 1 and 2 show the final selected solution before and after refining. The studies we have run have been limited in terms of the number of generated solutions. Studies with a larger population size and/or more generations could yield more significant results. In addition, our generator can be further developed to minimize the need for significant manipulation of the generated solutions to meet the objectives.

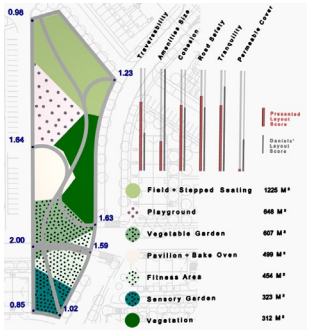

Figure 1: Selected layout, computer-generated.

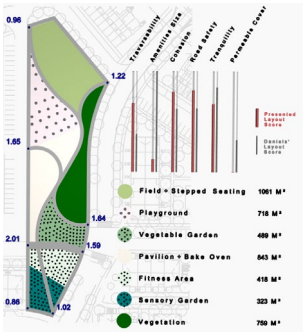

Figure 2: Selected layout refined by the designer.