Customizing Urban Pattern through an Agent-Based Approach

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ABSTRACT

This paper discusses the 3D space customization of design concepts within self-generated sculpture as an instigator for design of urban pattern. Appropriating from the concept of computer fuzzy logic, fuzzy design prods serve as exemplars of naturally occurring swarm behaviors. The hybridization of design through the 'mistake' and the different material vocabularies serve as departure points for the conceptualization of image breeding in 2D and for 3D grouping within urban pattern. Additive and eroding material processes spawn rule-based agent behaviors that assist the designers/artists to conceive and to enhance appearance and place. In an iterative process, swarm entities physically augment forms in an organic manner. The designer becomes the voyeur of their own creative input as swarm behaviors influence the placement and grouping of architecture/sculpture within the urban pattern of cities. In particular, this paper focuses on the agent-based approach whereby swarm behavior classifies residential, commercial and green spaces within urbanized areas.

Keywords: Agent-Based Approach, Evolutionary Image Generation, Space Customization, Swarm Behaviour

INTRODUCTION

Design is an activity that accommodates vast amount of information. No matter it is small or large; the designed object is a visual representation of the information. The more complex the design is the more information the product has. Any increase in the amount of information exponentially impacts on the design complexity. Lyon (2005) interprets designs as an activity that produces knowledge as a physical object. According to Schuster (1996) design complexity incorporates ecological diversity, complexity of construction (functionality), or internal complexity known also as the logical depth and the hierarchical complexity. Shuster mentions that

information in biology differs from information in chemistry and physics because of its affiliation with information technology and computer science. Biological complexity delineates itself through hierarchical classification evolutionary and emergent behaviors.

Modeling urban form can be regarded as a bio-inspired process similar to the logic of swarm colonies of ants or flocks of birds. In this paper we explain swarm parameters as a resource for designing urban pattern. The swarm model defines itself through corresponding sets of parameters that determine agents' behaviors and their relative interaction. An urban site can be replaced by any subject [image] capable of visual representation by defining and differentiating 2-D image grey scale value and subsequently projecting selective differences into 3-D height relief. The 3-D relief map could resemble a city with the buildings stretching to the sky, or it could represent a stage of ballet dancers, that become the protrusions in a site on which flying clusters of rule-based agents cumulatively create new forms. Examples of the process will be defined through the geometry and morphologies of the artworks of Gerald Hushlak, an artist using evolutionary processes in the spirit to Mendel and Darwin. Hushlak breeds drawings for harvesting as the first stage, which serves as visual image resource that translate into 3-D form. Image generation through breeding is close, and can be a self-generating system through weekly output in the hundreds as half dozen computers spew out in a 24/7 workspace. For aesthetic control, Hushlak chooses to intervene via sorting and manually tunes the process as it establishes directional design trends and bias. Encroachment into the process nurtures the education of the meaningful accident and mistake which would be lost in a self-generating process. Exploring the design space occurs through parametric changes among geometry and color relationships of generating images.

EVOLUTIONARY DESIGN AND GENERATIVE ART

As the culture of design evolves, digital technologies and scientific developments symbiotically partner with designers to replace earlier design technological procedures where drafting tools operated within tightly defined rule sets: presently we embrace the newer fuzzy tools as design partners. Not only, in architecture, are the entire buildings designed, documented, fabricated and assembled by digital medium, there are numerous attempts to utilizing them in arts and sculpture design. Through generative systems, the world is seen in a dynamic process (McCormack, Dorin & Innocent, 2004). It offers a paradigm shift for the design process in that design conceptualization shifts from creating static objects to creating a dynamic system and actions that manipulate it (Kuhn, 1996). With regard to system thinking, applying changes onto an individual parameter produces several changes and consequently impacts on the whole by nudging the results through relative behaviors.

There is a shift in the role of designers and artists. Unlike traditional artists who design art pieces, designers, today, take advantages of generative schema. In fact they involve in breeding objects by creating systems and modifying rules to generate objects rather than merely design them. According to Galanter (2003), artists use a system, which includes a set of rules or computer program set into operation resulting in the creation of art works. The results are diverse and dependent on the interaction among rules and parameters. The key feature in this generative approach is the ability of the system to autonomously provide a vast number of complex outputs. Through digital environment, users can assign values to parameters and to visualize them (Colakoglu & Dionyan, 2005). The iterative modification of parameters will result in a vast number of alternative scenarios, which need to be culled and tuned during the process.

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