

Modeling of the Self-organization of Urban Space and its Simulation

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[SYNOPSIS]

In the research of urbanization, the city agglomeration is explained by the concept of “comparative merit”, “scale economy” etc., but recently many people have interests in the phenomena of self-organization that the city agglomeration occurs based on the relations to the other agent’s behaviors and the other cities.

This research focuses on the agents dwelling in an area of city space (ex. inhabitants, corporations, etc.), and explores the mechanism of emergent processes by means of modeling the agent’s behaviors and simulating how the macro structure of city space emerges from the interactions of micro agent’s behaviors.

First of all we consider the mechanism of self-organization generally. Then we construct a self-organization model of city space using cell automata, and clarify the emergent process of city agglomeration and diffusion based on its simulation.

We explore the mechanism of self-organization of the central districts of Kyoto. The block structure is composed of the set of basic block, 120m x 120m (or 60m x 120m), consisting long, narrow lots. Buildings are built at the front side and gardens are located at the back side in each lot. This is a very creative rule, because broad open (or greenery) space emerges in a block from the sequence of open spaces.

In this research, we analyze the distribution of open spaces by means of various shape properties such as compactness, fractal dimension, cluster coefficient, and detect two fundamental rules of self-organization. We construct a model of self-organization processes in a block using NetLogo language, and verify those rules.

Today townscapes of central Kyoto districts are damaged by huge buildings or mansions. Various rules of townscape control are proposed in these contexts, but it seems to us that they are not so effective. As the result of this research, we propose some new design methods of townscapes based on self-organization principles in order to realize a sustainable environment suitable to historical city Kyoto.