“Cellular automaton” was a concept of discrete model in computability theory, mathematics, physics, and science originally discovered in the 1940s by Stanislaw Ulam and John Von Neumann. In 1970, a British mathematician John Horton Conway created the Conway’s Game of Life based on the cellular automaton system. The “game” is a zero-player game, meaning that its evolution is determined by its initial state, requiring no further input. One interacts with the Game of Life by creating an initial configuration and observing how it evolves. The Game is based on an orthogonal grid that contains cells of three types: activate, live, and dead. The former status of the cells and their neighbor conditions determine whether the cell live, die, or another cell is activated in the next step. If the game keeps playing, it may come to an end or keeps going depends on the grid boundary and initial cell status.
The project gets ideas from the study of Los Angeles’s freeway system and its grid. Los Angeles’s development was highly dependent on the automobiles during the mid-twentieth century. The freeway extended to a vast area, following the development of many large districts. However, Los Angeles’s districts are unique in terms of their separate functions and demography. The project is based on the argument that the grid system of Los Angeles is responsible for the separation of Los Angeles urban formations and people’s life. The project uses cellular automaton in vertical direction to generate a grid and seed conditions every level. Then the morphology transforms the individual cells into mixed, connected space formally and functionally. The project is a retrospect of the existing lifestyle in Los Angeles, and explores adaptive ways to create a new mixed lifestyle in Downtown LA.

Without any restrictions after the input seeds, the game grows with rules but lacks control and meanings. However, when look into the neighbor conditions of generated cells: a cell may be isolated, has one to four neighbors, or dead. Based on the analysis of those densities and neighbor conditions, designers evaluate and decide the functions for the space. In this way, the random results get meanings for human living.

“Cellular Morphology” is a bacterial taxonomy that refers to the form of bacteria, identifying the shape, structure, and size of cells. The term is introduced here to transform separated cells into new morphed types. The new types of space symbolize a new life style that the programs are mixed, private and public are blurred, and more communication between residents is enabled. In the residential tower, different programs are distributed and repeated all over...
the tower rather than certain functions are confined in one or two floors in normal skyscraper. The system can be adapted to other places and urban conditions. By changing the definition of suitable and rules it transformed, the system can have different organizational and morphing ways to adapt to different urban context.

IMAGE CREDITS
All image credits to Yuan Yao

YUAN YAO is currently a fifth year architecture student in the University of Southern California. In 2011, with the influence of Zaha Hadid’s work, he began to get touch with Parametric design. He is interested not only to use parametric tools to generate different forms, but also interested in integrating parametric in design process like analysis and fabrication. His design strategy is based on extensive explorations in both digital and physical forms to find out the most or multiple potential ways to influence the performance of existing conditions.