

# Pattern Generated Architecture

## A response to homogeneous development projects in Tokyo

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### 1. Introduction

The redevelopment of areas in Tokyo such as Osaki has led to a situation where the urban fabric has been interrupted and displaced by high-rise buildings of three main functions: offices, commercial and residential. This has resulted in the production of large-scale projects that lack the narrative of Tokyo's urban evolution. They are oversized and completely alienated from their urban context creating a "gigantism" effect (an excessive leap in growth), that dislocates the urban fabric.

### 2. Tokyo historical background

As a result of two major events in Tokyo's 20th century history, the great Kanto earthquake in 1923 and the bombing of Tokyo during the Second World War, the urban fabric of Tokyo has been erased and redesigned to accommodate its growth. Lack of organization and specific guidelines morphed the urban layout into a chaotic and diverse branching system with no specific grid or system governing it (Fig.1.1, Fig.1.2).

#### 2.1 Osaki's urban evolution

Osaki serves as an interesting study case in terms of the evolution of the city. Located on Tokyo's most important transportation route, the Yamanote line, Osaki started as low-rise detached housing combined with light industry. Along the years the strip of industry that sliced through Osaki and interrupted its urban continuity started giving way to a more unified texture of residential buildings combined with heterogeneous functions.

#### 2.3 New developments

The constant change in urban demographics, as well as the problem associated with both inheritance law and the short life span of Tokyo's buildings, has resulted in a situation where most plots are suffering from constant subdivision and shrink in size from one generation to

the next. In response to this, new development projects have begun to replace the naturally evolving urban fabric (Fig.2) with massive volumes that artificially host the same functions (Fig.3, Fig.4). The new volumes constructed stand out in their huge scale in urban context, creating a type of architectural "gigantism" with a large void around them (Fig.5).

### 3. Project

This project attempts to reintroduce and trace some of the urban qualities that exist in Tokyo in general and in Osaki in particular with the aid of pattern based algorithms.

#### 3.1 Program

The main emphasis of new developments is on the economical aspect, an approach that leaves aside some basic functions that help mold and stimulate urban growth. In Osaki's case the amount of galleries, museum and venue spaces in comparison to other new development projects around Tokyo are relatively low (Fig.6). In this project the main program is a theater with all the services related to it. Parts of the project will be dedicated for further stimulation of artistic behavior in this area.

#### 3.2 Urban patterns

When examining patterns in the urban context it is possible to see numerous combinations of space composition created all over Tokyo. These spaces with extended voids created around them generate chaotic sensation the city possesses. In the production of new developments these special characteristics are converted into a linear and pseudo-rational distribution of space. Programs that were once hosted randomly over a three-dimensional space are replaced with a homogeneous and linear volume.

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Shibuya

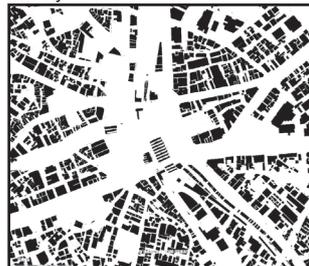


Fig.1.1 Urban pattern in naturally evolved area

Nishi-Shinjuku



Shinagawa



Fig.1.2 Urban patterns in new development area

### 3.3 Pattern

In order to learn from the urban fabric and regenerate it in a new development project the functions hosted in it must be separated and patched together in an organic manner (Fig.7). The use of generative patterns prevents the rigid distribution of program in space and inserts unique characteristics into the design (Fig.10). The implication of pattern in architecture is more than simply aesthetic. Patterns have embedded in them two significant qualities: the first is variation in scale and form. Using a pattern assures diversity in the design, yet preserves the elements bound together under a set of rules. The second is an innate logic and sense of continuity of the space created, as well as the possibility of future evolution.

### 3.4 Method

In this project the first phase of the design was done using a Voronoi pattern to distribute the program in the site. Each program's spatial requirements were determined and then represented as a point. These points were then placed on the site in relationship to each other, as well as the existing site conditions. Once all the points are placed the voronoi equation was applied. This equation creates an irregular grid of spaces that are by definition, formed by their relation to the spaces surrounding them. Once the cube of voronoi subdivision is created it is "stripped" down to pieces and reassembled with each space adjusted to accommodate its function (Fig.9).

### 4. Conclusion

This project attempts to provide a more organic response to these conditions by designing through the use of generative patterns extracted from morphological precedents found in nature. By deploying these natural systems, the original conditions of the city can be traced and propagated to create a landscape of urban continuity.

### Reference:

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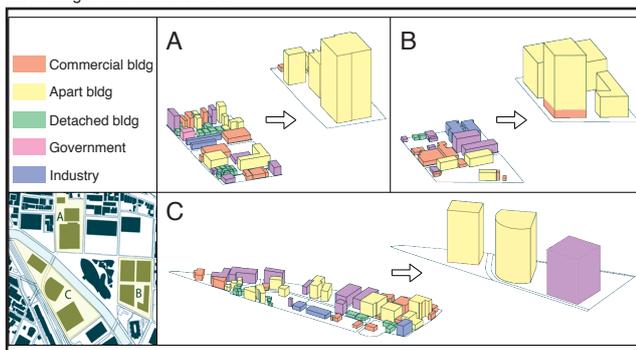


Fig.2 Osaki's shift in volume and program in the past 10 years

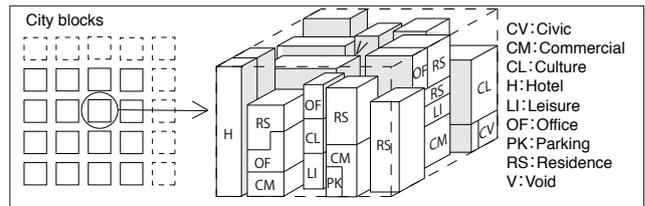


Fig.3 Distribution of urban program in a city block scale

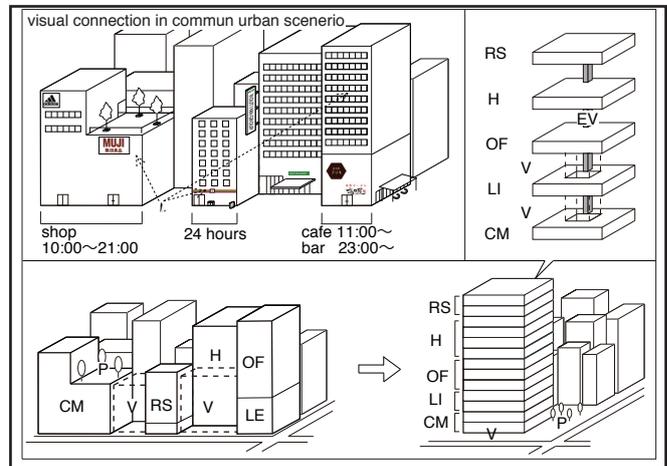


Fig.4 Linear distribution of urban functions in new developments

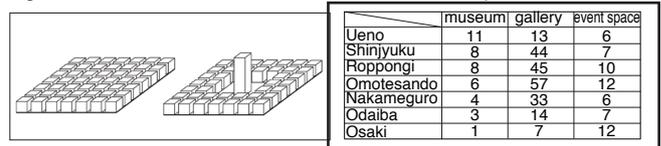


Fig.5 "Gigantism" effect in block scale Fig.6 Artistic space distribution

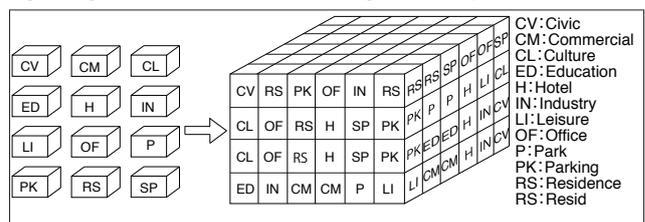


Fig.7 "Organic" repatching of urban functions

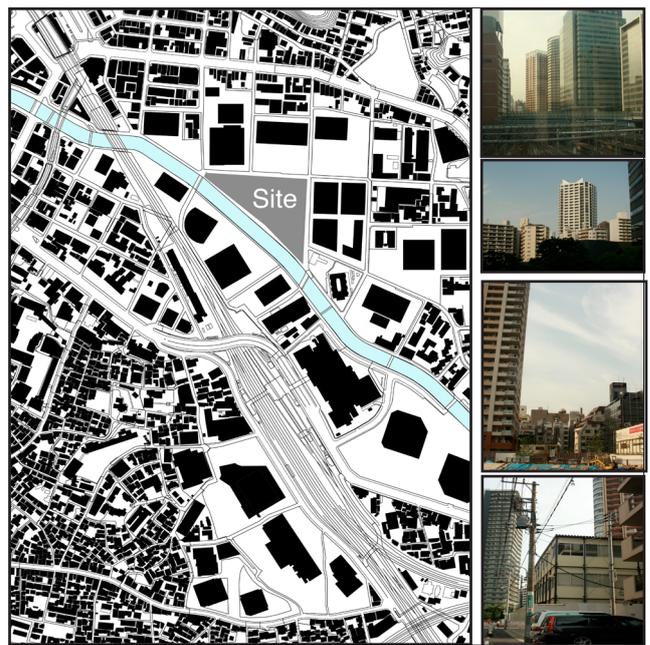


Fig.8 "Gigantism" effect in Osaki

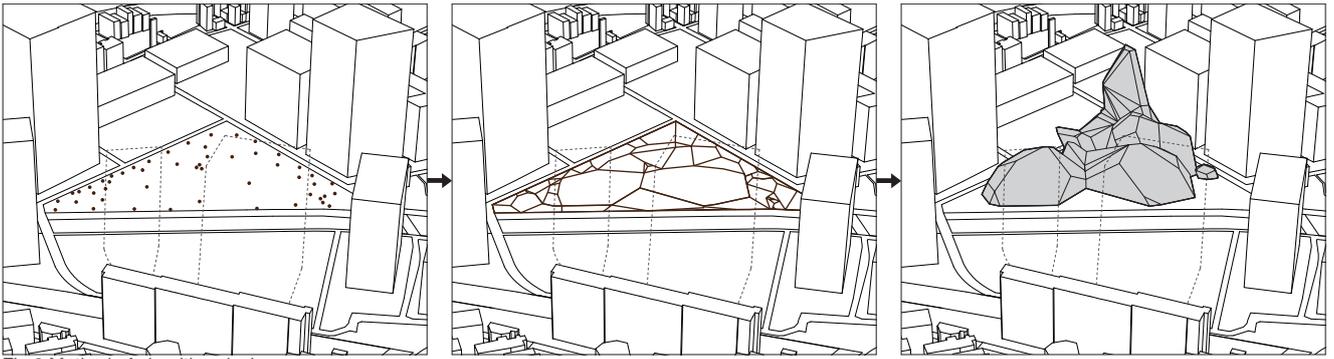


Fig.9 Method of algorithm design

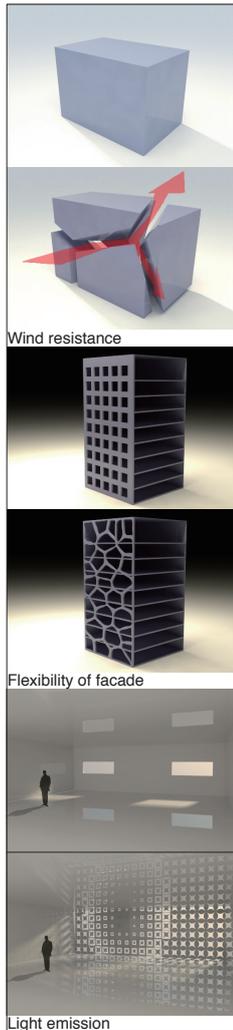


Fig.10 Application patterns in architecture

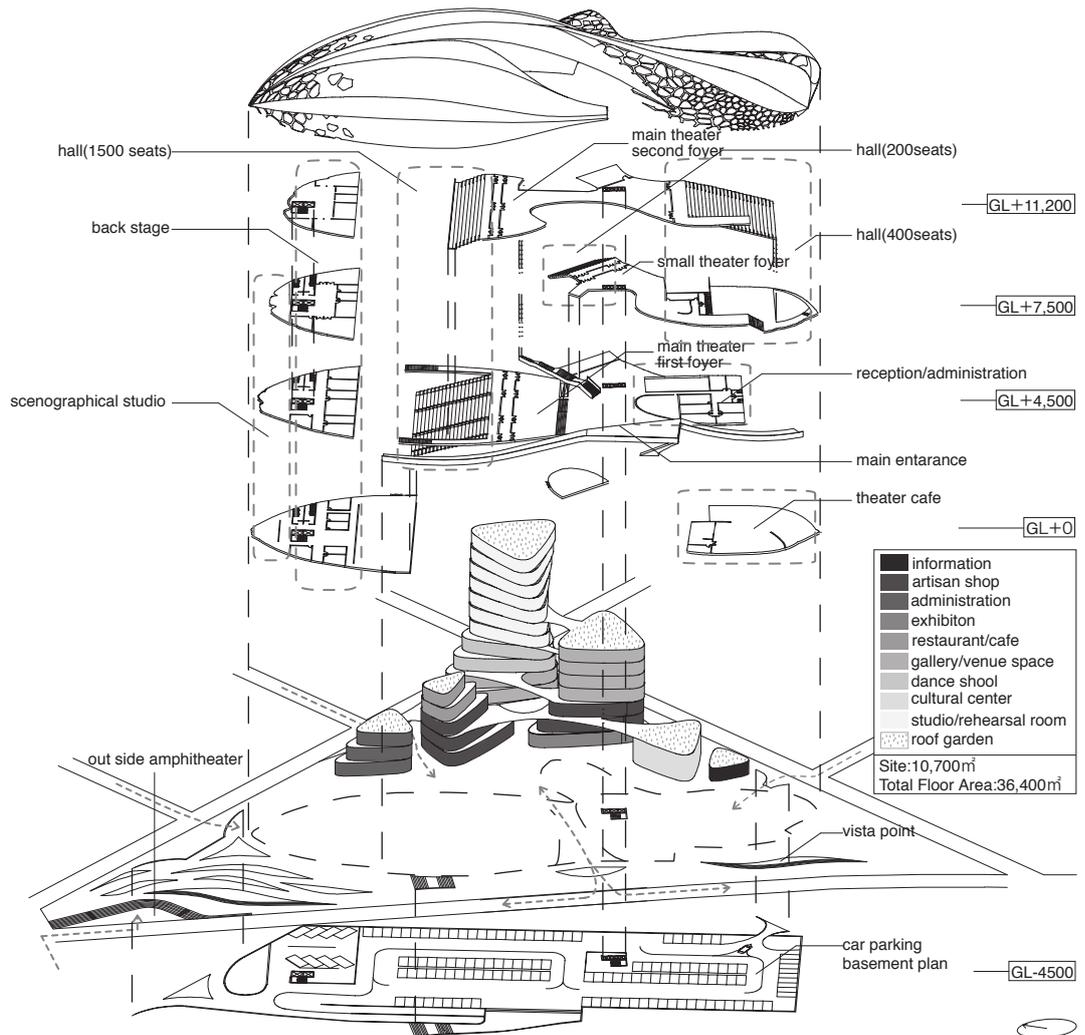


Fig.11 Explosion

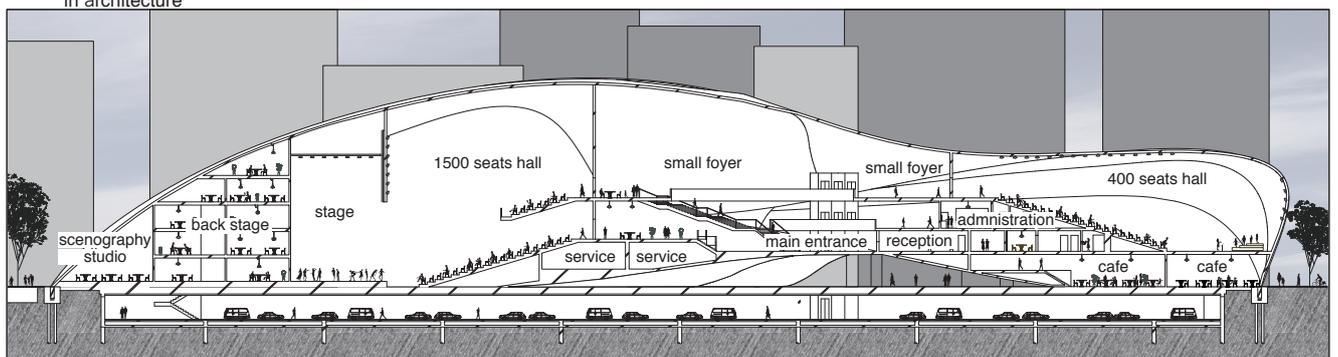


Fig.12 Section S=1/1000



Fig.13 View of the main entrance



Fig.14 Northern towers

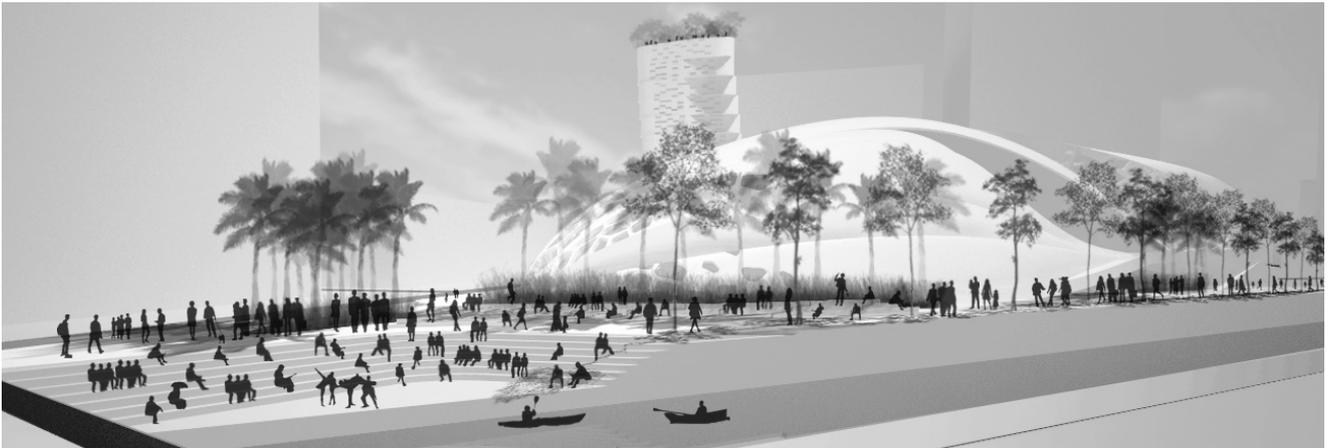


Fig.15 View from the bridge

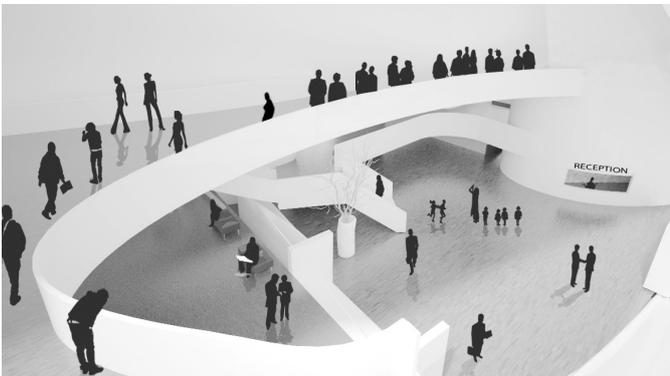


Fig.16 Main entrance hall



Fig.17 400 seats concert hall

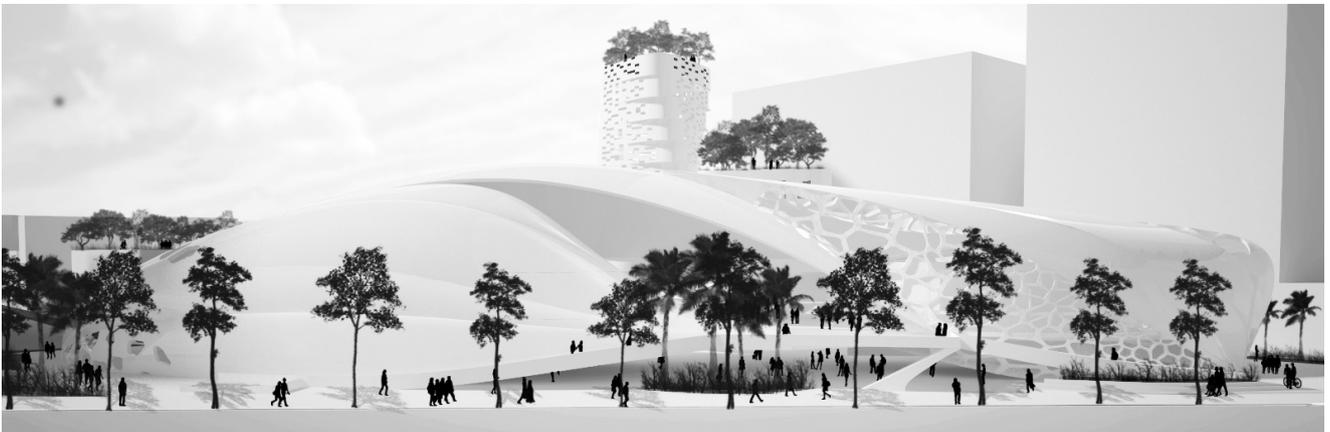


Fig.18 Southern view of the theater