S.M.A.R.T.

Hong Kong

Report for the Architecture and Media Studies

for the Hyperbody Graduation Studio

by Lars Hammer

Study Number: 4024834
Date: 23/12/2016

S.M.A.R.T Hong Kong

The graduation project of the Hong Kong Hub dives deeper into the topic of high-density architecture, particularly with S.M.A.R.T. architecture and parametric architecture in mind. When exploring the subject of high – density architecture in Hong Kong, several problems were encountered. In this project the focus will be on just three of these issues. The unavailability of good daylight design, the local sound pollution and the unavailability of healthy / public spaces. To support the decision to integrate S.M.A.R.T. architecture components into the project, an additional research was done about prototyping.

The unavailability of good daylight design can lower the quality of living In the buildings or neighborhoods significantly. This means enough light for the traffic routes within the building and for the residential units. A proposal for this project should at least offer an improvement in daylight design.

This goes hand in hand in creating livable spaces for the people to hang out, in a close proximity of their own houses. Currently the few parks available to the tenants of the building plot are far away, and thus do not provide a good solution for socialization. It is important, especially in high density buildings, to provide a space to socialize in a relaxed environment with a certain amount of privacy. And thus open spaces for the tenants to come together in the building should be designed.

Another big issue found in the center of Hong Kong is the high sound-pollution. This is caused by the high traffic and people on the streets as well as due to the city design. This creates a loud and continual noise for the first few floors from the ground up, tackling this problem will greatly improve the quality of living in the

Day-Light Design

The daylight design within this project will be applied with simulating swarm behavior with a pre-determined amount of residential volumes. This is done in such a way that the highest amount of residential volumes are being well lit by daylight.

1. We will have weather data, which provides us with shading as well as sunlight hours.

2. We can determine what the minimum sunlight hours are the swarm needs to flock to. The shading will be in a more direct way to determine a location for certain volumes. (shaded= only public space and commercial space, no t shaded = a combination of those + residential).

3. At the not shaded spaces, we will apply a residential volumes of which the total floor space can be varied, in order to fit the total required floor space.

4. Eventually the volumes which do not need any snlight hours, will be applied to the shaded side of the building.

5. These steps result in a general building configuration.

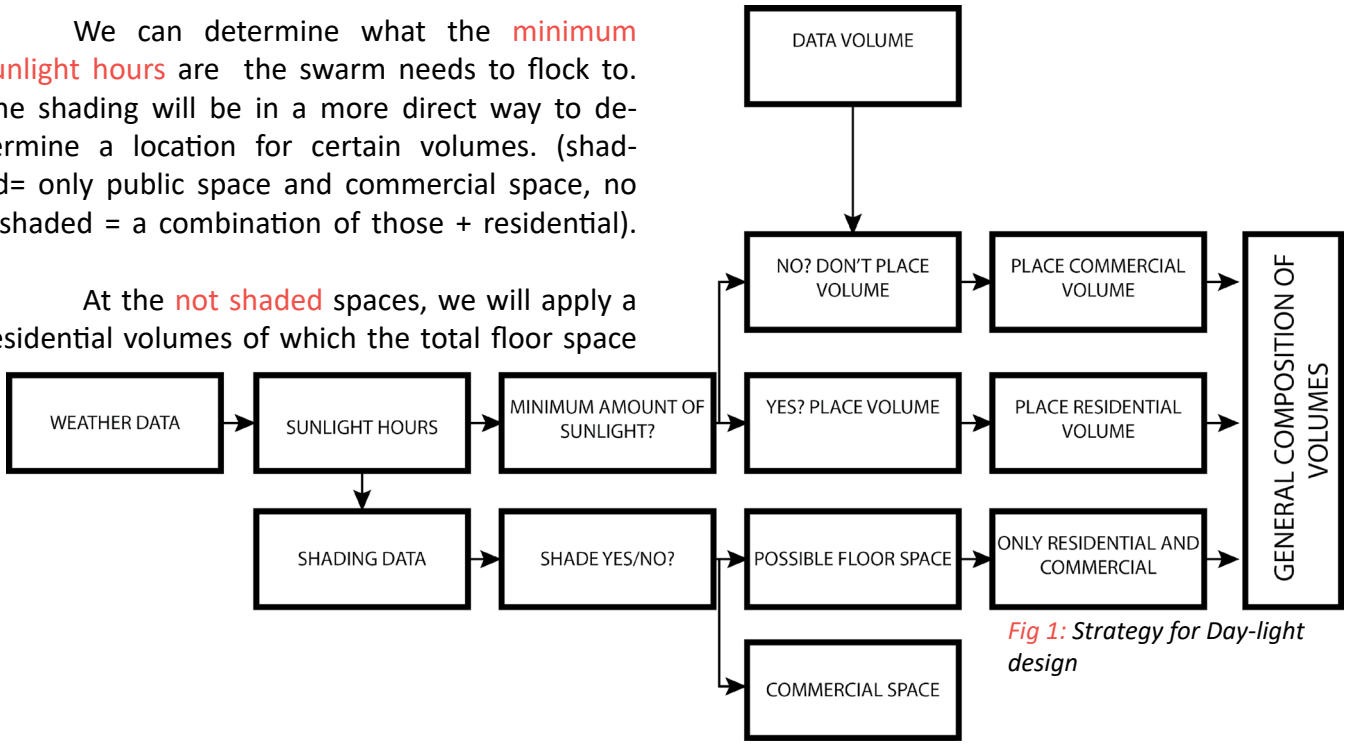

Fig 1: Strategy for Day-light design

Public Spaces

Livable public spaces will be applied in the Hong Kong Hub to provide a nice place for leisure time for the inhabitants of the building and her surroundings. Related to the distance and amount of residential houses in its proximity, as well as for good daylighting, a location within the building is determined.

1. The weather data will provide us with sunlight hours, important for the vegetation in the public parks. This will be applied on the general configuration of volumes generated in the 'daylight simulation' .

2. The distance from the residential volumes to the Park-volumes will be determined from the CenterPoints of each volume. The amount of residential volumes per park volume can thus be tested.

3. The parks should as well be placed above each other and attached to traffic shaft to make for good efficient indoor traffic.

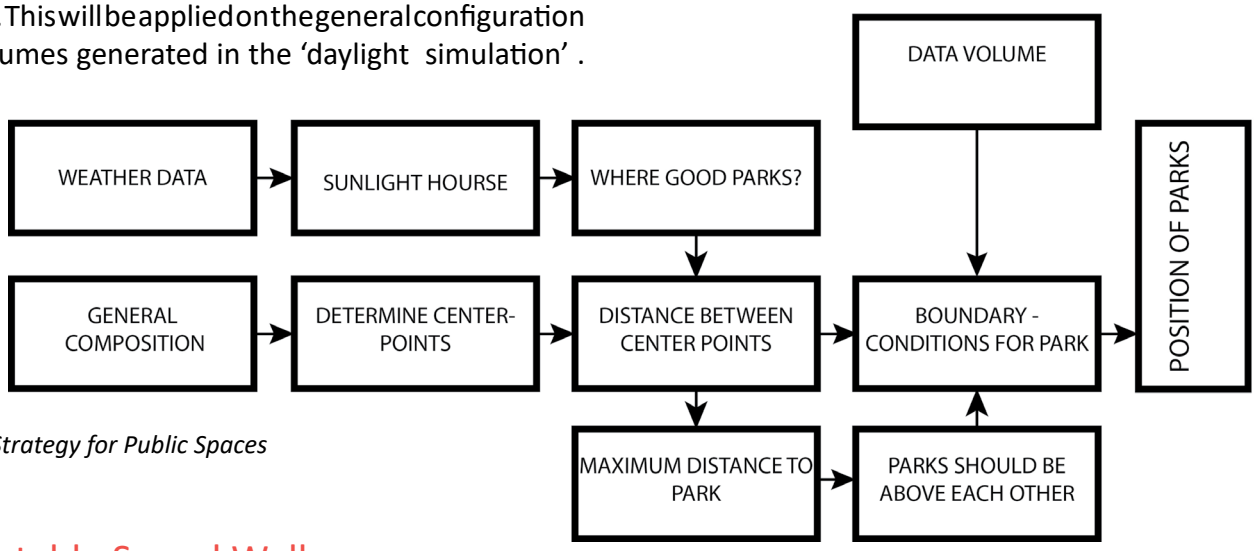

Fig 2: Strategy for Public Spaces

Adaptable Sound Wall

Adaptable sound-wall will react to a specified amount of environmental noise nearby. This sound level is often directly related to the amount of people and cars on the streets which, dependable on the location, is higher during the day and lower during the night. A S.M.A.R.T. architecture solution is chosen to raise awareness to sound pollution but also for the adaptable implementation of sound absorbing panels, creating a dynamic atmosphere.

1. For this solutions we will need Traffic Data as a source, to determine how crowded it is on which parts around the building plot.

2. These crowded spots are used to determine the strength of the sound source on the streets and relate them to a specific period of the day.

3. With the previous generated configurations of the building it can be determined which volumes of the building will be in danger of sound pollution.

4. This way we can determine where an intervention is need, as well as the shape of the intervention.

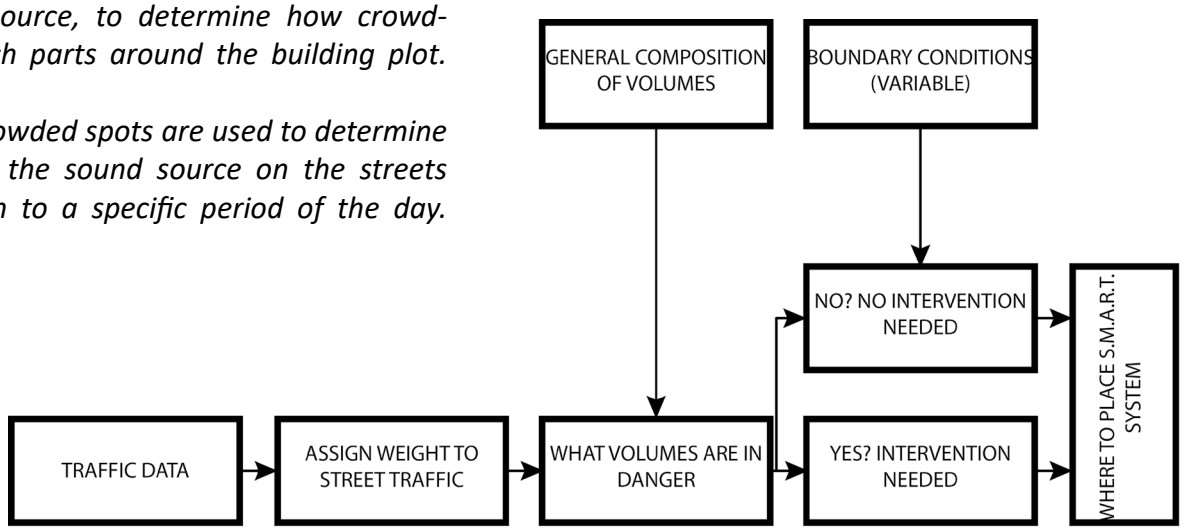

Fig 3: Strategy for the Sound Wall

S.M.A.R.T. PROTOTYPING AND THE SOUNDWALL

An essential part of the design is the prototyping of specific S.M.A.R.T. solutions. This will show the efficiency of the envisioned product as well as knowledge into the subject. Prototyping is especially interesting with adaptable systems, and thus we will relate in this paper to prototyping and the solution to noise pollution.

It is important to distinguish between two specific S.M.A.R.T. systems and its protoypes. The two systems are a system-oriented and a people-oriented system. A people-oriented approach characterizes itself by "empowering people to make informed decisions and take action as mature an responsible individuals who are in control" A space can guide the inhabitant into making certain decisions, but ultimately the person is in control of what happens.

The big difference with the system-oriented approach is that in this case the space would be in control of the situation by making decisions on what to do next and actually taking action and executing them without a human in the loop. Just like the automatic heating of a building. (Streitz, 2006)

The noise control, which is an important part of the design, will be dependable on the sensors which measure the sound level in the streets, will they reach a certain value, the adaptable façade will change its shape in order to create an noise controlling façade/advertisements. Since this will be a fully automated process, we will take a system-oriented approach.

During the Game Set Match symposium, many interesting prototyping strategies were discussed. For example the 'Buqs' prototype by Joris Hoogeboom & Teun Verkerk. Buqs is a 'system-oriented' sound artwork, which make sounds with their environment by hammering on the surface they have been placed on. They are independent of human behavior, but react to each other and thus are interactive objects. They are designed to make space more pleasurable and consists mainly of a solenoid, pager motor and a piezo speaker, connected through a wireless network which acts according to swarm behavior (Hyperbody TUDelft, 2016). This independent system is an interesting approach which could be applied to the noise controlling components envisioned in the project, making them more efficient to deal with any noise problems.

The assembly of prototypes to show the effectiveness of some design is of high importance as Nimish Biloria states in his paper; Inter-Active Spaces. A multi-Disciplinary Approach towards Developing Real-Time Performative Spaces (Biloria, 2006). With analysis of 'the Muscle Projects; Biloria states the importance of a few elements in prototypes; Pneumatic Entities, The Black Box, Flexible Skins, Control Systems, MIDI and PCI cards and software" (Biloria, 2006).

These elements force us to think about which elements will be part of the noise control solution. Pneumatic Entities could be used to transform the wall into a position that it blocks the living units on the higher floors of any noise pollution. The pneumatic elements would be activated in an 'on' – position when a continuing loud environmental noise is detected. The lowered elements would be in 'off' – position, triggered by an absence of a continual sound. Noise-sensors would be placed all around the building on strategic places and send the collected data to the Black Box. The black box would also inhibit the control systems, which in this case would evaluate when and how long a noise must be present, and which sound absorbing panels will be implemented to offer perfect protection against the sound pollution.

References

Biloria, N. (2006). Inter-Active Spaces. A Multi-Disciplinary Approach towards Developing Real-Time Performative Spaces. In L. F. Kas Oosterhuis, Game Set and Match (p. 615). Delft: Technical University of Delft.

Hyperbody TUDelft. (2016, 11 10). GSM3 S.M.A.R.T. Environments. Delft, South Holland, The Netherlands.

Streitz, N. (2006). Cooperative Buildings, Ambient Intelligence, and the Disappearing Computer. In L. F. Kas Ossterhuis, Game Set and Match II (p. 601). Delft: Technical University of Delft.