Nocturnal Artifact
Symbiotic Landscape Design through Environmental and Animal Computation.

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1.1 - Introduction

The objective is to find neglected spaces that are consequences of urban planning and activate them in a manner that promotes them in an emergence of cybernetics patterns. These fragmented spaces can be the roots of cybernetic patterns that are connected through their spatial and physical manners that are part of a larger Internet of Things (IoT).

There is always unintended consequences that occur through the relationship that are produced between the elements. The culmination of these spaces create a fragmented network of neglected elements that are disperse throughout Tokyo. The neglected spaces have a strong tie to the urban wildlife that inhabit the city. Through the use of animal computation, we can see through their lens an emergent pattern of neglected spaces and understand them as places that have a high potential to intervene a design strategy.

1.2 - Thesis topic

Identification of neglected sites through a natural process of urban ethology and animal computation resulting in their development into biodiverse symbiotic environments through which human integration benefits physical and mental health of users in the city.

1.3 - Hypothesis

The relationship between Japanese house bats (Pipistrellus Abramus) and the built environment reflected through the population of roosts is sign of the level of biodiversity and symbiotic relationship between the bat, insects and plants.

For sites to attract specific local animals such as the Japanese house bat they require to already posses the appropriate conditions such as existing biodiversity and climatic conditions (wind, sunlight etc.). Locating these sites with preexisting bat population can identify the neglected spaces that posses the appropriate conditions and potential to be further developed into a more efficient symbiotic environment. The ability to understand and generate a symbiotic environment allows us to develop natural environments and ecologies within the urban environment which would normally be only possible in a wild context. Optimizing neglected spaces through animal computation generate natural symbiotic relationships and integrate these fragmented spaces into a cybernetic network that is constructed through animal computation. Having access to this biodiverse network of natural landscapes can ease the stress of people across Tokyo (Park 2009).

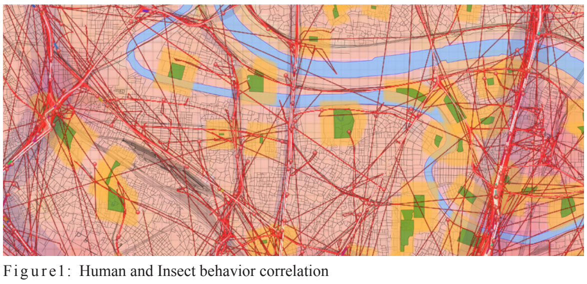

Figure1: Human and Insect behavior correlation

2.1 - Procedure

Using bats as an agent, animal computation as a the method to outputs a series of different pattern of where these bats tend to roost.

The process to develop the neglected sites into symbiotic landscapes is as follow:

- Identify the sites with preexisting bat population
- Identify the sites with potential through the site selection process (Section I paper)
- Through the study of the animal behavior, identify the relevant plants that promote a symbiotic environment between plants, insects and bats.
- Optimize the layout for vegetation to grow to its full potential through climatic conditions without conflict of nutrition (Section II paper).
- Through the process of wind flow analysis of the site, generate a design to influence wind flow on site to benefit both humans and insect behavior (Section I paper).

2.2 - Measurement of success

The overall success of the area is determined by the increase of bat population as measurement of symbiosis and health of the space. The increase in population demonstrate that food is efficiently sourced throughout the active season. The sites can be judged against one another to see if there is any discrepancy in the coding of the program.

2.3 Human Behavior

Through the design system we enhance neglected spaces which directly affect human behavior and their perception and appreciation of these spaces. Furthermore the way the green spaces are spread out across Tokyo is a result of our human behavior that influences how Tokyo is built and continues to grow.

2.4 Animal Behavior

In the same way human behavior can be understood through Tokyo infrastructure and urban density. We can also understand animal behavior as part of urban fabric. However where we may see limitations such as rivers as boundaries, animals such as the Japanese Pipistrelle may see them as habitats or highways to move around the city. In order to completely understand the behavior of bats through the urban fabric, research was conducted into understanding their flight and hunting behavior in order to fully comprehend how they move or hunt through the space.

3.0 Symbiotic Landscape

The area of Suidobashi along the Kanda River was selected through the site selection process. This location fulfilled the necessary requirements to start the design process. An analysis of the site is done so that the data collected can be use to optimize the site to achieve the natural biodiversity. One of the foundational parameter that is needed to layout the vegetation in a natural randomized order is a sun and shadow analysis. The size of land and the amount of sun determine which plant is best to be allocated.

Size plays a large role in the optimization, the average circumference of a Hazel tree will be around 3 to 3.5 meter wide while the Willow tree can reach up between 15 to 22 meters wide. Since the two tree share the same similar amount of daylight requirement of needing ten hours of daylight, they will come into conflict at those location. The Grasshopper script will therefore optimise as much variety of different species as possible into the site. A greater variety of plants will gather a greater variety of insects across the year.

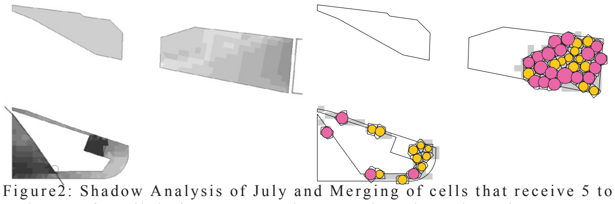

Figure2: Shadow Analysis of July and Merging of cells that receive 5 to 10 hours of sunlight into a voronoi pattern based on plant size.

Through animal computation the active months of the bat were divided into three periods. These three periods aim to allocate a variety of vegetation that will actively attract insects at different times of the year. Information is structured in Grasshopper so that each period will hold vegetation that will be active in these periods. The trees that were selected follow this same patterns making them attractive towards insects in the early stages of the active period of the Japanese Pipistrelle. The second and the third period will have a mixture of shrub and bushes that produces flower and leafy greens.

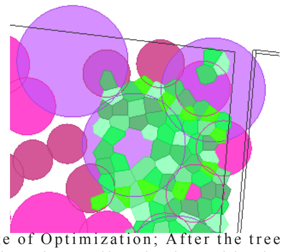

Figure3: Final Stage of Optimization; After the trees have been optimize into the site then the smaller shrubs and bushes will be added in between.

4.0 Design background

The design process is the incorporation of the human behaviour into the symbiotic environment with plants, insects and bats. Research demonstrates that the common ground on which both the positive effect of strong wind on human activity and as well as its negative effect on insect and bat behaviour could be tapped into to incorporate the human activity into the symbiotic environment. The design agenda was therefore to concentrate human activity around strong wind areas that would provide more comfortable conditions for people to enjoy the space while avoiding insects. Through design exploration this agenda of optimising the design was developed to further influence wind flow through the site and concentrate it within the strongest location in order to enhance the qualities of the entire site for human, insect and bat activity respectively.

Through the enhancement of the wind within the generated design the influence have a positive effect on insects and human behaviour; strong winds are favourable for human usage through its ability to decrease humidity especially during the hot summer months. However according to biologist Anders Hedenstrom (2015), strong winds (29-38 km/hr) would stop bats from using a space. Depending on the specie of insect, wind flow will also detour insects from flying in certain conditions (Barton 2014) with for instance mosquitoes (Diptera: Culicidae) avoiding windy areas with wind as weak as 0.4 to 1.6 meters/sec (Hoffmann et al. 2002).

4.1 Design process

The process begins with the identification of the area with highest wind velocities, the system will generate the design intervention on the site. The process of analyzing the site through the wind analysis is by taking the 3D model into AutoCad Flow and getting a graphical data as an output. With this graphical data we are able to use Grasshopper to differentiate the colors of velocity into a set of grouped RGB. The group of RGB will demarcate where the implement of the design will intervene.

A boundary is established based on the wind conditions which comes from the RGB. This process allowed us to generate a wind tunnel shape that elevates itself above the ground.

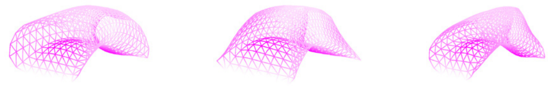

Figure4: Karamba optimization structural design iterations

Throughout the design process data has been the driving force to communicate the symbiotic relationship between the different agents in the site. To implement a physical design into the area that has been optimize to enhance the symbiotic relationship of the site, the design will have to embellish the output that has been produce by the optimization. The design of the tunnel is aimed not only to represent the data but also to influence the output of wind. The surface of the design represent wind flow and velocity through the distribution pattern. In order to generate the surface pattern and design, the optimize shape goes through the wind flow simulation to measure the velocity and flow direction around the surface of the shape.

Once the wind analysis are applied to the surface, it is possible to apply different timber slates with varying spacing between them to represent wind velocities on the surface. Wind analysis and optimisation conducted for the design are based on the average wind flow recorded across the year, wind is coming from south-south-west at a velocity of 7m/s.

In order to find the best way for the structure to hold without loosing structural integrity an aggregation optimization to find a optimum structural skeleton for the shape. The method and chosen parameters for the surface aggregation optimization allows to create a more organic and natural structural skeleton that is able to blend in more naturally with the optimized design and surrounding landscape. In order to run this aggregation optimisation pressure force of 10pa on the surface of the solid optimised shape with load supports at end of the tunnel. After the completion of structural optimization, the result is transformed into metal pipes.

Once the entire design is completed we ran it again in a wind flow simulation the result increases the wind flow within the tunnel but also decrease the surrounding wind flow.

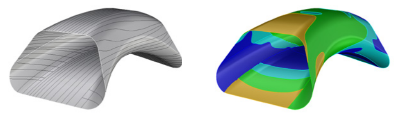

Figure8: Wind direction (left image) and surface pressure velocity (right image). 4 recorded speeds are applied as different patterns for the surface; yellow, green, blue and dark blue. Yellow being the highest and dark blue the lowest wind velocity and surface pressure.

5. Conclusion

Through computational understanding of how relationships and tendencies of agents in the urban condition can translated into data allows a design intervention to take place. Animal computation with optimization of data that is a result from climatic conditions can target neglected spaces to produce a symbiotic site that have a design intervention that is driven by the resulting optimization for the enhancement of human, plants, insects and bats.

Reference list:

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