

REFLECTION

Biomimetics in architecture



The relationship between research and design.

My project can be linked to the overlap between the fields of architecture and biology. The research grew out from a fascination for nature and started at the very beginning of the field of biomimetics. It is a search to intelligent solutions from nature for design problems in architecture. My research provides the basis for my architectural design.

My project goal is; to educate and inspire people about the opportunities and ambition of biomimetic design, through an architectural design situated in nature which is adaptable to the change of its surroundings and try to appropriate and reuse nature's resources responsibly. This design will be a pavilion located in nature, in the Veluwe [The Netherlands] and will deal with the local climate and use local available building materials.

The relationship between the theme of the studio and the subject/case study chosen by the student within this framework.

Explore Lab is a studio which gathers student attempting to work on a special assignment not covered by any other studios. Sometimes students from other studio's search for an answer in the field of biomimetics but the field is too wide to exactly understand the meaning of biomimetics without doing serious research. So they can be inspired by a particular phenomenon and use that as a solution in their design but it isn't possible to really go into the field of biomimetics and understand where it comes from and how it developed.

There are two opportunities to start with a biomimetic design; You have a specific problem and you search for a solution in nature. Or you have already a fascination for a specific phenomenon and you want to understand it fully and translate that into a design. You need a specific, clear and good formulated approach for which you seek the solution, otherwise you'll get lost in the greatness of nature.

The relationship between the methodical line of approach of the studio and the method chosen by the student in this framework.

In the studio of Explore Lab you don't have many obligations. You have to do like all the other gradu-

ation students, follow the graduation manual, hand in all the forms on time and succeed the five presentations. What is different from the other studios is that there is more emphasis on the research and you must hand in a research document. Also you have to organize a workshop, lecture, excursion etc. for the studio, which is important to keep contact with the other Explore Lab students. You can follow in this studio your own methods and be more independent. These possibilities were for me an important reason why I chose this studio.

The relationship between the project and the wider social context.

The principle behind biomimetics is that in 3.8 billion years evolution nature has already found solutions to many problems which humans trying to solve. And living organisms have been perfecting and optimizing their wares without consuming fossil fuel, polluting the planet or risking their future. This optimization process is about trial and error experiments, and as a result of that nature has created an enormous pool of effective solutions.

Living organism have unique integration geometries and techniques that allow them to adapt to different environments. Nature have learned to optimize and adapt itself to their surroundings because they have to survive.

Besides that we can learn a lot from nature we also have to look back in history and understand the principles behind vernacular architecture. Climate-adapted buildings exists since humans struggle for survival by changing climatic conditions with clothing and shelter.

This method of building called autochthonic building, which uses the resources of the immediate environment.

In addition to local available building materials this includes the climate. Depending on the climatic conditions, types of housing evolved to withstand heat, cold, rain or wind, with the goal to provide safety and comfort. The traditional buildings are usually energy efficient, and can also serve as a great model to learn from. The thermal comforts of these buildings are often extremely good. Sustainability in traditional societies is less measured but the traditional connection to nature is just normal and of great importance.

In traditional architecture it is important that the built structures expresses harmony with the environment.

Biomimetic design attempt to understand the principles behind biological systems and use these

principles in an architectural design.

The objective is to employ biomimetics as a tool in architectural design and the aim of biomimetics in architecture is innovation.

Innovation will help to solve current problems in architecture and environment, and new fields of architecture and design will be explored.

Biomimetics in architecture will help develop a culture of active environmental design.

Biomimetics has a significant normative content and promises to provide solutions of exceptional quality.

Its promise of better, more ecological and appropriate solutions, derives from the tested and proven optimization of biological models through evolution.

The exceptional quality of biomimetic solutions manifest itself in three aspects:

- In a low degree of risk
- In a greater possibility of ecological appropriateness and thus a contribution to sustainability
- In a previously unattainable ingenuity with the respective solution, which mostly is justified with reference to a fundamentally multi-dimensional optimization process

The operating envelope of an engineering system is frequently much wider than that of a biological system, which has often evolved to deal with one very specific task.

A problem in architecture is that a lot of architects are concerned much more with the aesthetic aspects than with the functional ones.

Living organism's on the other hand, are examples of design strictly for function, the product of blind evolutionary forces rather than conscious thoughts.

The goal of architect's and designer's have to be to develop ways, to appropriate and reuse nature's resources responsibly. The challenge today is the balance or eliminate waste, by developing ways to build with limited environmental impact and without abuse to the natural world. Mimicking will not be the solution for a more responsible design, it is all about understanding how nature works and use that knowledge and intelligence in order to make an improvement.

So when architects and engineers feel more responsible for nature and have more background knowledge about the basic principles behind biological systems and the lessons we can learn from it, it would be easier and more exciting to make a better sustainable design.

Several biomimetic design strategies are available for various applications, through the research on biomimetic as a design tool in architecture is still challenging. This is due to a lack of systematic design tools required for identifying relevant organisms, or natural systems, and abstracting the corresponding generic principles for implementation in design concept generations for building envelopes.

It is of great importance to operate with a team of people from multiple disciplines and with different backgrounds, to understand more of the complexity of nature.

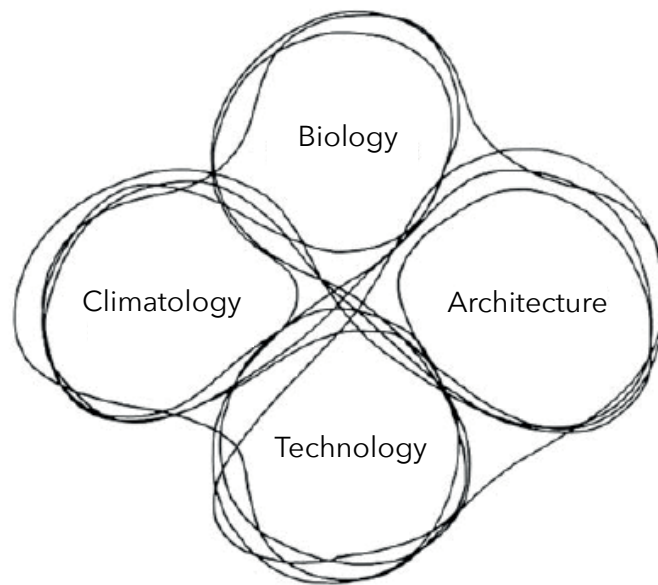
Reflection.

My research clarified that it was impossible for me to make a complex design which I had in mind. Of course it was impossible to design an ingenious pavilion without a clear architectural problem, without a specific phenomenon in nature, without a lot of background knowledge and without a team of people. You need people from other field with lots of expertise and a lot of time to make a successful biomimetic design. Because of the complexity, biomimetic designs exist most of the time on paper and are not built in real life.

My research clarified also that it is all about 'be adaptable'. Nature and traditional architecture are adaptable because they have to survive. This fact became the starting point for my design. So my pavilion doesn't have new innovative technologies, I didn't reinvent the wheel. But instead of that I designed a beautiful pavilion that brings nature and people a little bit closer together. That shows what nature gives us every day and that we, as humans, have to take our responsibility. The location determined the behavior of wind, rain, sun, temperature and light where we have to deal with. Like animals, plants and people adapt to their surroundings also buildings can be more adaptable. We have to design smart buildings that fits the location and minimize pollution. We have to think more in closed loops and minimize waste. And we can only achieved this if we will work together.

"It is not the strongest of the species that survives,
nor the most intelligent that survives.
It is the one that is most adaptable to change."

[Charles Darwin]



Model of environmental processes [Olgyay 1963]

