WHAT IS A BIONIC HOUSE?

In essence, this model of a house differs from a traditional bioclimatic building by focusing on growing food and providing for its inhabitants, so it is somewhere in between architecture and a greenhouse, or it is a house that is also a garden. The “bionic” part comes from the fact that the building is quite active and has the ability to behave autonomously in order to perform its functions, so in a way it can be described as a “conscious” or to a certain degree “robotized” house. However, more than an industrial beast full of cables and heavy machinery, the design patterns that the project follows are the ones present in existing plant lifeforms, so the building indeed behaves as a living creature, but more as a tree or a flower: its activity is more subtle, slower and less energy consuming.

The original motivation behind the project was the desire to design a minimal building able to shelter and provide everything needed for a person’s livelihood (energy, food) whilst also taking care of its waste and functioning as a closed-cycle system. In addition, some new functions in sync with the modern IoT and domotics era needed to be incorporated in a sensible and appropriate way to the design (maintenance, climate control, waste management). So, whole ecosystems and especially the plant lifeforms were the main inspiration as they are very similar to my desired building in their use of scale, use of time, productivity and efficiency of processes and energy management.

The buildings can be redesigned by imitating some of the plant features to perform better by combining their traditionally separate structural, facilities and finishing elements into more integrated, detailed and sensitive, slower and self-regulating systems. Another way the buildings can be improved and made cheaper to run is by using their scale and the time at their disposition by using slow, spontaneous, often chemical or gravity-led processes to perform the functions which are now powered by an external source of energy. So even though this type of design requires some careful planning and detailed design, it is just a carefully arranged combination of a multiple small adjustments (often inspired by organic shapes and structures), common sense and use of available materials and technologies. With a small central processing unit with few controlling parameters, the building can be set to perform its tasks mostly autonomously and with little interference with the outside world or with the people living inside. So to say, the house can grow and do its thing besides people as an alternative environment to current inert spaces we mostly spend our days in.

Just like in any mixed environment, while combining the productive or agricultural space with a house, many complications and unexpected results often occur, however, the new needs also bring new tools and options to work with and opportunities to rethink the essence of what a house should be like. For example, a vast amount of water will have to run around the house at all times, which is energy-consuming and heavy for the structure to support. At the same time, this water can also be heated outside or absorb all the excess heat, balancing out the heating and cooling costs of the building. The same happens with the questions of ventilation, humidity control, illumination, maintenance and hygiene. Architects can learn many things from greenhouse design and agriculture, and much more from ecology and biology, so we can design buildings that exist in harmony with their environment, and carry out their functioning, at least in part, on nature’s broad shoulders.

In case of this particular project, there are several key features that permeate all the design decisions that come from natural sciences. While designing something that provides for itself and keeps running without generating pollution or waste, I am in a way reproducing a working ecosystem, or giving it a shape of a house. So, things that are important to keep in mind are:

- The main function we are aiming to perform should be the slower and the downhill part of the energetic cycle, so to say. A spontaneous process should do the task we need to achieve, and the readjustment should be the uphill part, performed manually or using an external (or an internally stored from before) energy source. This will make the system perform in a safer, more reliable way.
- We need to have a network of simple options to perform a task, instead of having just one optimized route. This is generally more sensitive and appropriate if we want to make a full use of changing external conditions and scarce renewable energy sources, and makes our system safer and with big coping capabilities. We need to have options, especially when we go off-grid. Having compatibly designed systems and energetic pathways able to seamlessly share the tasks are a must in a house that is willing to behave as a natural system.
- Refrain from using high-intensity performing systems that induce us to use high-intensity power sources such as fossil fuels and electricity. Use slower and lower-wattage systems on a longer timescale or in a bigger size option, within reason. In general, avoid electric power usage except for some AC powering the minimum amounts of lighting equipment, some sensors and our computers or phones running. Energy transformations are costly and houses mostly use thermal, chemical and mechanic energy. Keep it, store it, capture it, but do not transform it for no good reason. Like in all living beings, things
that we cannot produce by ourselves are usually toxic to our bodies. In a same way, energy that a house cannot produce by itself, is toxic to our planet.

So, a house that has many layers and systems that work together, how sophisticated should it be? Living beings have a complex microscopic structure that cannot be reproduced in a building wholly, so is it even sensible to try and make a building using life as a functioning model? Won’t this make the design crazy expensive and complex?

Well, probably here lies the main challenge of the project, for it to work properly as a living being many functions and demands must be satisfied at once in the same space. Nothing in a living being is just a structure, just a protection, or just a storage unit. Everything has multiple reasons to exist and several uses, and we need to think the same way while designing any element of the building. We need to stack many low-performance, slow and essentially simple systems together to create a complex, multilayered creature and view and attend many different functions at once. The idea is to define the main tasks or processes to prioritize and then use some of their byproducts to facilitate another process so we will optimize our energetic pathways as lifeforms do.

Inside that aura of general multiplicity, all systems should be easy to understand and to function as simply as possible. There is also no need for complex equipment to perform on a level of a standard house, all the parts should be replaceable with some simple 3d-printed parts or components from a home depo. In this aspect, a house should be regarded more as a tool than a solution, or at least it should offer a possibility to be repaired without a need for an expensive high-tech service. The living creatures have a way of self-renewal and self-maintenance and so should our houses. The design should be sophisticated as long as it is not taxing.

And how smart should it be? Many functions usually require many controls and cables and mechanisms. However, I still think that most functions that a house performs don’t need to be informatized. The trees grow and move and adjust to their environment without nervous system. So I will work with systems that function mostly on water pressure and compressed air, or on stored mechanical energy, and will be set off by the external needs of the house, making the functioning systems mostly automatic. Some small parts will need sensors and input from the people living in the house (their preferences, routines, scheduling, suggested optimal energetic pathways, etc.) but in general, a house will be a soft automata, only overridden by manual control in extraordinary cases. There is no need to register and informatize everything in this project. In general, a manual option for each task that the building performs is always required, for the safety reasons and for the sake of psychological wellbeing of people living in it. So, a broken automatic system should be designed as usable, by manually activating it. So some shift to a simpler, not so high-tech solutions, is a good idea. A person should not be left powerless in case of an energy shortage or an unexpected event, in a house that normally acts by itself.

Lastly, the model of a house I am designing will surely attract many environmentally conscious people interested in some alternative living solutions. I am aware that the project is in a way a combination of the modern technologies at our disposal and at the same time a reaction to excessive amounts of artificiality of our living environment caused by our technological progress. I usually use a moderate approach to designs and try to go back to nature, but in a way, my project is made possible by many technologies. So even though I am aware of environmental costs of the materials I am working with, at this point I mostly work with plastic and rubber materials that some people may find polluting. Maybe some day things will change and the alternative solutions in clay, glass or wood will be possible, but this is work in progress.

The project is experimental and nobody knows where it will get. Please keep an open mind and do not expect flawless performance at the first try. This is a study of a new way of making buildings more active, adjustable, pliable, soft and alive, in harmony with the elements around and the people inside, and with nature as a backbone.