

THE DESIGN OF ARCHITECTURAL SPACE THROUGH SYSTEMS OF NATURE.

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ABSTRACT

Nature is an inexhaustible source of solutions to formal, functional, structural and constructive among many other problems, is the result of a long evolutionary process and adaptation. The design of architectural space has managed to reproduce some aspects of nature looking for the comfort of human beings; however in the field of use of natural resources we have exceeded, causing an imbalance that was reversed in the transformation in the way of living, demanding a change in the design of architectural space.

Climate change impacts rural and urban communities, threatening the world with affectations unprecedented, despite multiple warnings, there are still marked contrast in how communities relate to the environment, concern for the environment has grown, it evolves over time but still not enough. Various fields of architecture have posed problems and solutions in the field of teaching environmental concern led us to generate new knowledge in the architectural design process, demanding to consider the impact of climate change as a condition for the pursuit of livability.

The design of architectural space is no longer focused on the aesthetic or stylistic value of architecture is conditioned by a flexible methodological process that requires feedback between the environment and the building.

The methodology focused on the analogy of natural systems can show how the form, function and structure are some aspects that efficiently integrate design of architectural space applied in various projects of our authorship allowing generate and build comfortable and friendly spaces the environment.

The designer of spaces is the executor, climate change is adversity, nature is your tool solution, but nothing works individually if they are not linked in a methodology guide who will serve for generation of Architectural Design.

It is important to assess the process of generating architecture, encouraging academic participation through tools that allow the study of theory and generating efficient architectural projects.

INTRODUCTION

The human being seeks to solve your needs looking around him, no doubt, nature has offered a large number of resources in terms of materials, forms and structures that takes up and play, until now only been explored a minimum percentage for use, is latent a lot of knowledge to analyze, it is time to study the organ systems of nature, avoiding overuse of materials to their advantage.

What has not been explored much of nature?, the answer is obvious, there is much knowledge that human beings would not finish analyzing it and turn it into something useful for your comfort and benefit, organic structures have an extraordinary, perfect and functional design , stressing that its existence is no accident, have all its elements neatly organized so that can not fail, failures are a result of having its term, or that something or someone has intervened for-the modification time, age, etc, climate change is one of the main factors that has influenced the modification of the product nature of human activities, including natural organic structures tend to be modified by external elements or phenomena that make the operation is changed to the degree of exterminating them, but none of the organic manifestations disappears by itself, but someone or something intervened to end its cycle.

When an architectural project is designed, it is intended to fulfill a purpose, every space is designed so that all organized each have a smooth operation. Nature shows the function for which it was created, works together and is organized according to their capabilities, although there are some natural events that seem to have flaws, the fact is that they have a specific function, found organic forms as rare that appear to be the result of

chance, nonlinear those who do not obey any geometric pattern, but beyond their appearance perfectly fulfill its function.

Undoubtedly the study of nature can generate controversy and discussion, but this article aims to disseminate the greatest number of resources, forms, structures, organizations and patterns that are useful in creating architectural spaces that help give guidelines solution to the tangible needs that human beings in their live, all in search of comfort in the built environment, the objective of this research is to find and implement the organic manifestations that provide theoretical design resources, from the geometric to the mechanic, how to support the generation of knowledge to the study of the theory and efficient generation of Architectural Projects.

Design Methodology

The expression 'Design Methodology', as the design itself, covers a large area, a set of disciplines in which the key is the design and development for predicting how they will be things and devise appropriate tools to the objectives preset.

It is one of the fundamental steps for generating projects, which part of a theoretical background leading to the selection of methods and techniques to achieve specific objectives and ultimately the overall objective, an appropriate product design or space.

Consequently, the design methodology integrates sets of indicators and prescriptions for solving the problems arising from design, it determines the most appropriate sequence of actions, content and specific procedures.

There is no single methodology that can be adapted to the needs of any architectural project, there are several methodologies that can come into symbiotic relationship. The methods and techniques involve technical knowledge to be adapted to the circumstances and purposes.

The methods and techniques always refer to features and provide partial solutions making it more appropriate to refer to the design methodology as the study of the structure of the design process

The validity given to the use of either method or technique in the structure of the design process is given by the scientific paradigm in which it is located.

The methodological framework can characterize the scientific practice of architectural design, consisting of a systematic search for integration of theories, methods, techniques, tools, and in general formulas of scientific action of various sub-disciplines, from an interdimensional conception of discipline addressed and recognition of the relative character of scientific approaches separately. (Vilchis, 2002)

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Climate Change And Design Process In Architecture

As a result of climate change is necessary to steer the process Proyectual Architecture (methodology for the design of architectural space), through the study of natural systems to be an instrument that substantiates the design that allows creating comfortable and friendly spaces with the environment.

Consideration of environmental conditions and ecosystems of the environment in which they are designed, built and used architectural spaces for maximum performance with the least impact, is an exchange of information of the Physical Environment Natural (Schjetnan 1997), and architectural space, with the analogy of natural systems base elements: You may resume all elements of the natural system and lead them in the design of architectural space.

Retake one (s) of the elements of the natural system to take advantage of some natural phenomenon, inducing promptly in the design of architectural space -Search Confort-.

Retake one (s) of the elements of the natural system to reduce the impact of some natural phenomenon, inducing promptly in the design of architectural space -Search Confort-. Another area inspired by natural systems is the use of sources of 'renewable' energy (solar radiation, rain water, wind, etc.), through the design of passive systems inspired by nature for heating, rainwater harvesting, cooling, lighting and other equipment, thereby reducing the use of nonrenewable energy sources.

Consideration of environmental conditions and efficient use of renewable energy affects the cost of buildings, affecting minimizing the overall energy balance of the building, covering not only its use phase, also its design phase, construction and end of its life.

All this part of the quest to foster increased quality of life for building occupants. Complying with the requirements of hygrothermal comfort, health, lighting and occupancy of buildings. (Garrido, 2012)

These lines allow the architectural design studio from its theoretical bases, foster environmental education in the designer and the user set a standard evolve in the teaching-learning process and promote sustainable design. Some projects of our authorship empelando the analogy of natural systems will be described below.

Development

Analogy of Natural Systems. Analysis of organic and inorganic natural physical environment to be considered in the life cycle of architectural space, making the most with the least impact.

Medusa *Compass* – Sea University. Campus Library Puerto Escondido



Fig. No. 1 Medusa 'Compass Jellyfish
– Mediterranean Sea.



Fig. No. 2 Sketches Library Project
Sea University.

Chysaora hysoscella is one of the most beautiful Mediterranean Sea jellyfish, commonly known as "Compass jellyfish". This species of jellyfish usually avoid being around other jellyfish, and has the distinction of being able to change sex.

The aerodynamic shape allows you to swim smoothly, and travels to the deep sea, enduring great pressure.

The first idea was generated retaking aerodynamic characteristics of the fluids, shape allows you to collapse the body, which is driven and causes easy movement.

Under these characteristics the shape of the jellyfish was redesigned to design an architectural space for the Library of the Universidad del Mar. Campus hidden Puerto, exposure to hurricane winds of the proposed site caused that buildings were affected, therefore it is looking for a form of durable and non-orthogonal building, to avoid the shock of the winds.

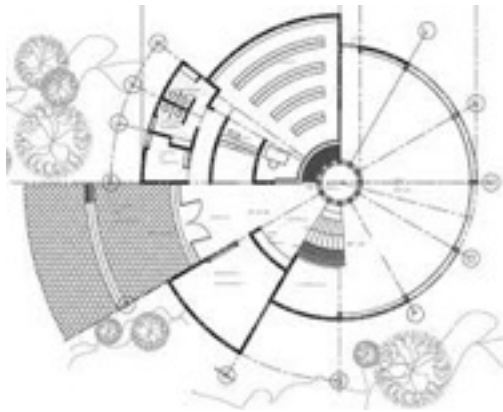


Fig. No. 3 Architectural plant.

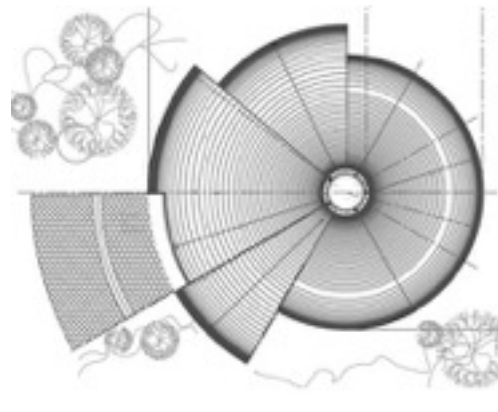


Fig. No. 4 Whole plant.

The hemispherical undulating movement of the jellyfish forms a kind of funnel which is driven, and that element was mimicked to conceptualize the central form of the project as a ventilation system and lighting of architectural space of the reading room and lobby.



Fig. No. 5 Library Building. Sea University. Puerto Escondido, Oaxaca, Mexico.

Caracol – Design Workshop

The snail is an invertebrate animal which is divided into two parts: a foot and a shell that uses home. The shell or the land snail is spiral-shaped and grows to the same extent as the animal grows



Fig. No. 6 Snail Shell on.

With the foot can move around any surface, for it must alternate contractions and stretching. It is believed to move 10 cm per minute

Based on the organic form of snail, a workshop that had enough space so that the user could work in different activities such as carpentry, painting, sculpture, pottery etc. designed



Fig. No. 7 Snail Shell top view (7a) and lower (7b).

The space consists of a system based on snail shape to generate a constant ventilation that starts at the main entrance and ends on the last part of the space and the top helicoid.

On the top it seems to have no way out, but the bottom may notice a hole, possibly functions as vent, in the case of the project take this feature to generate passive ventilation from the floor and traveling airflow all space and exit through an opening to be built on top of the structure.

Snails hibernate when (during the cold months or in summer when the weather is too dry), seal the opening with a dry layer of mucus (linesina). By analogy with the architectural design the main access will be controlled as thermal insulation.

The workshop Project is associated with the interior spiral staircase, this helps your structure more stable.

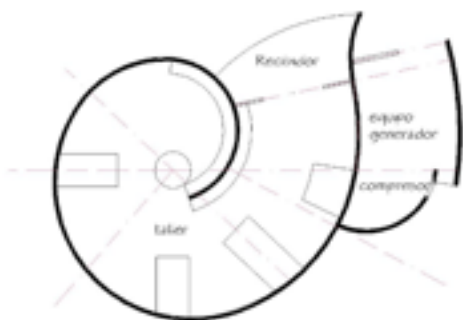


Fig. No. 8 Architectural plan based On helical land snail stroke..

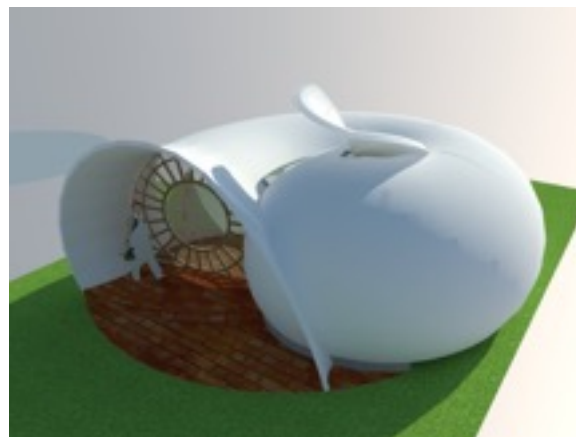
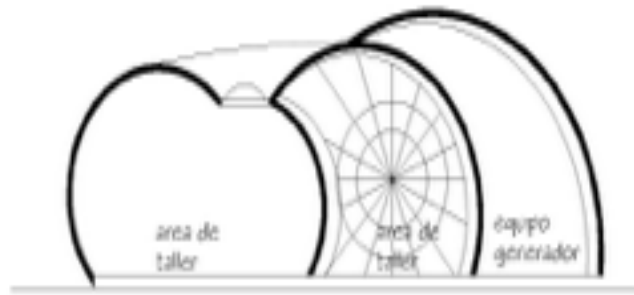


Fig. No. 9 Overview 1 architectural space.

Fig. No. 10 Cross section based

Fig. No. 11 Overview 2



on the helical line land snail.
architectural space.

Edge Land Snail – House Room

The analogy of natural systems can be total or partial. The House Room below illustrates that induce allowed based on the edge of land snail, giving continuity and rhythm at the top access.



Fig. No. 12 Ferrocement construction system..

Fig. No. 13 Organic forms and emphasis of access on the edge of the land snail.

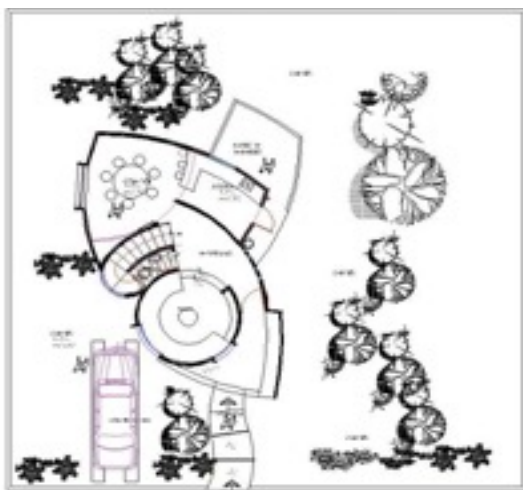


Fig. No. 14 Architectural plant.

Fig. No. 15 Main facade.

Shrimp - Auditorium and exhibition hall.

Exhibition Hall auditorium for 350 people - 420m2, resort to withstand the impact of hurricane winds, seismic activity and expand the sound without the need of using audio equipment. The source of inspiration was the shrimp, was selected to study the species filled with design, motor skills, structure and improved performance by millions of years of evolution marine world.

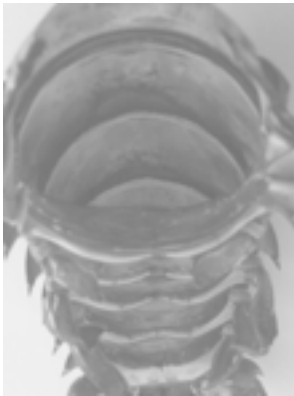


Fig. No. 16 Cavite shrimp.

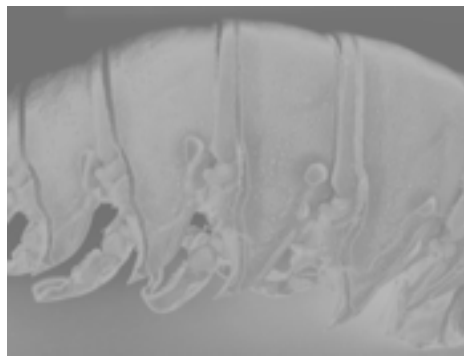


Fig. No. 17 Locomotion shrimp.

The shrimp has an organic form of double curvature which gives you the tools to move on the seabed conditions, sudden movement and helps her escape winding in certain situations, the semi-conical shaped its lower end helps move the rest of your body inversely to the direction of his head guarding the rear, the lower end is composed of segments arranged so modulated and arced downward in the cavity articulated by a membrane that is retractable to the effect of locomotion.

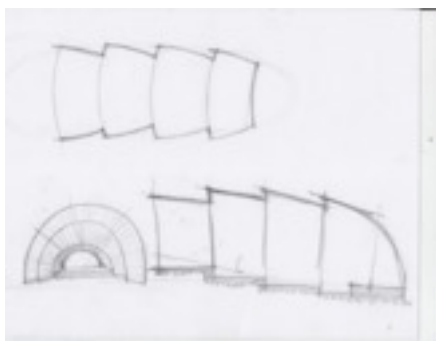


Fig. No. 18 Body modules.

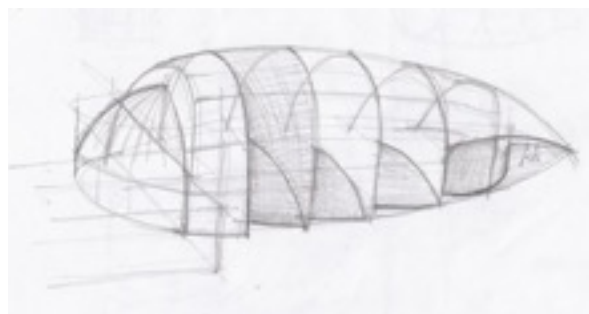


Fig. No. 19 Ribs rigidify cavity.

Organic design based on the study of the structure of the exoskeleton of shrimp resumed, the modules of its roof and its double curvature make it resistant protecting it from predators, turn the aerodynamic shape helps you in your travel, this feature of locomotion it is an inspiring element to the project to provide aerodynamic shape that prevents winds cause damage to the building.

The construction system used was the ferrocement, which being thin and absorbs strong earthquakes that occur in the proposed site.

The segments in decreasing sense of crustacean modulation offer space for the spectator area, the requirement is to rid the area covered without resorting to supporting elements, the ribbed arches of the inner cavity work on the structure used self.



Fig. No. 20 Whole plant.



Fig. No. 21 Perceptival point of the project.

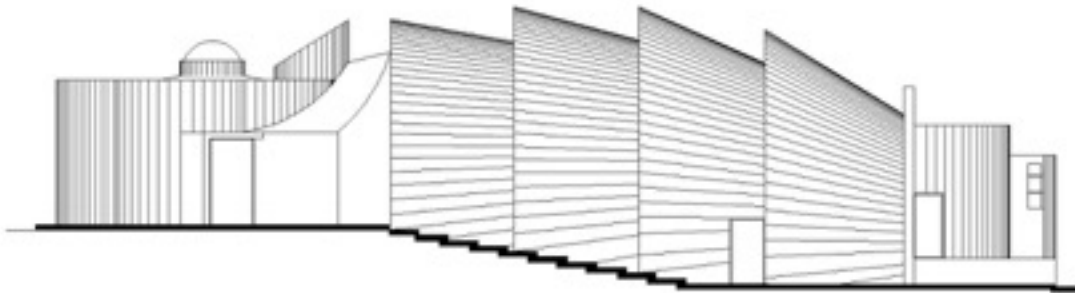


Fig. No. 22 Right side front.

In Fig. 22 segmentation can be seen from the stepped modulation shrimp body was studied and analyzed the topography to generate staggering, visual forum to the spectator area and integrate acoustic solution with form conical area viewers. (Sánchez – Sánchez, 2013)

RESULTS

Sea University. Puerto Escondido, Oaxaca.



Fig. No. 23 Right side front. UMAR.



Fig. No. 24 Main facade.. UMAR.



Fig. No. 25 Interior view of the bleachers. UMAR



Fig. No. 26 Showroom. UMAR.

Analogy of Natural Systems. Passive systems design inspired by nature for the use of sources of 'renewable' energy.

Elegant leaf – Slab funnel.

By analyzing and studying the natural characteristics of the leaves (Example elegant leaf - xanthosoma), which have the ability to capture, lead and harness the rainwater, it could design a Slab funnel (Sánchez—Sánchez 2016)



Fig. No. 27 *Xanthosoma* (elegant leaf)

Through a flexible membrane ferrocement it is possible to construct organic forms, by referring to the natural characteristics of a slab elegant leaf which allows to collect rainwater for transport to storage containers and subsequent distribution was designed. (Sánchez y Sánchez, 2014)



Fig. No. 28 Detail of the slab funnel.

Fig. No. 29 Overview multipurpose area.

Alcatraz – Slab funnel.

Fig. No. 30 Alcatraz

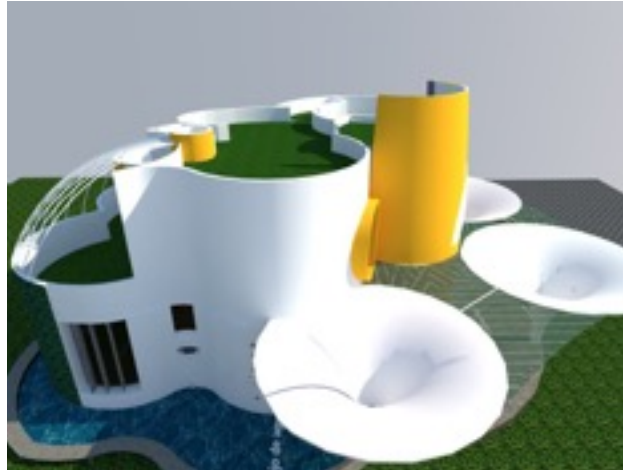


Fig. No. 31 Aerial view of the house room.

A single slab funnel can cover the entire architectural space, obtaining benefits such as reducing exposure to solar radiation by the use of organic forms, formal stability through the self-supporting structure and its high landscape aesthetic value; However, they can be induced in different parts of the funnel smaller slabs architectural complex, allowing block solar radiation on specific areas, make more rainfall to capture it in different areas of the complex at the same time and integrated as an aesthetic and landscape features.

CONCLUSIONS

Natural systems are inspiring elements of architectural design, beyond the formal aspect of nature has perfected its biotic and abiotic elements to such a degree that they are perfectly integrated systems.

In -based organic design in nature- reinforcements distributed throughout the structure drawing forms and bio-structural integration, this approach reduces larger sections to deliver clear older. Using this type of analogies in architectural design weight of a building both its superstructure and its foundation are distributed uniformly reducing the use of elements of support-structures autoportantes-.

The architectural design is more than the functionality of the interior space, it must be supported by a deep shape analysis, function, context and environment, generation and teaching architectural composition as part of the architecture must evolve the degree of adaptation to climate change.

Teaching architectural design should not refer to the fulfillment of a design process or methodology of spatial design step by step, it should be a guide that allows the designer to enrich, modify, adjust and improve the benefit of an architectural project that optimizes multiple aspects the quality of life of the user.

PROJECT REFERENCES

Arq. Jesús Sánchez Luqueño
Collaboration: Dra. Liliana E. Sánchez Platas

Library Sea University.
Campus Puerto Escondido, Oaxaca, México.
Design concept: Medusa
Status: built.

Design Workshop.
Arq. Jesús Sánchez Luqueño
Design concept: Caracol
Status: conceptual phase.

Home room.
Design concept: Snail access
Status: built

Multipurpose Room
Esc. Sec. Tec. No. 189
Huajuapán de León, Oaxaca, México.
Design concept: hoja elegante
Status: built

Auditorium and Exhibition Hall.
Sea University.
Campus Puerto Escondido, Oaxaca, México.
Cañada University.
Teotitlán de Flores Magón, Oaxaca, México.
Sierra Juárez University.
Ixtlán de Juárez, Oaxaca, México.
Sierra Sur University.
Miahuatlán de Porfirio Díaz, Oaxaca, México.
Design concept: Shrimp
Status: all built.

Home room.
Design concept: Alcatraz
Status: conceptual phase