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The tipiti and biomimicry

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ABSTRACT
With the advance; that of changes; climate change, solutions; In the field of architecture and design, they preserve the environment and help to reduce or mitigate the impacts of generation; CO2 in the atmosphere are a response for future generations; architects and designers. The aim of this article is to contribute to the study of elements of indigenous culture that are connected to the principles of biomimicry. The ancestral knowledge of observation; the phenomena of nature and the use of biological resources present in Amazonian communities are a source of inspiration; contemporary society in the search for a balance between the environment and the development of new technologies.

Keywords: Biomimicry, Design, Change, Climatic ones, Tipiti, Indigenous culture.

1 INTRODUCTION

With great concern, to which they change; climatic diseases have been generating in the population; to the World Cup, due to the elevations; On the other hand, it is necessary and urgent to apply multiple ACs; to be effective in the short term. Among others, minimizing expenses with non-natural materials, preferably using low to zero carbon materials, and valuing the application; carbon-sequestering materials, such as natural materials, and reuse. (ARCHITECTURE2030, 2024)

In this sense, to express an architecture that integrates sustainability parameters, AI-Sehai et al.(2017) highlights that we must build with efficient processes, optimized structures in the necessary performance, "zero waste", control the internal environment with bioclimatic concepts and produce our own energy from renewable sources and water management. The author notes that the concept of biomimicry presented by Benyus (1997) has as the main approach "nature as a source of knowledge and inspiration; "It didn't have a focus on sustainability. 0 author reinforced; to which the context of materials and structures, appropriates; The concepts of "nature or biomimicry" had already been studied by other researchers recognized as "Joseph Monier (1823 - 1906), Frank Lloyd Wright (1867 - 1959), Buckminster Fuller (1895 - 1983) e Frei Otto (1925- 2015)".

Natural structures have been specializing over billions of years, defining efficient and fine elements by the double-curved shapes such as tidal waves, the tensioned shapes of spider webs, among others.

Ladurner et al.(2012) argues that "biological organisms acquire their functional efficiency and adaptability through the interaction of their components". Therefore, they "are extremely efficient in the use of materials applied to complex geometries."

The cultural elements of the indigenous peoples can be observed under the 6th of biomimicry, especially the utensils such as basketry, building enclosures, tapestry, etc. due to natural fibrosis materials. Rapoport (2006), one of the greatest specialists in the relations of popular architecture, published his first book in 1969 House Form and Culture, studying the relationship between the forms of houses, the construction techniques in different cultures and observed how traditional architecture is embedded in symbolism and that which did not incorporate technical knowledge, such as the indfgen. Therefore, it is relevant to identify and study studies that evaluate the relationship of different cultures with biomimetic concepts and how they have appropriated them.

The objectives of this work are to evaluate elements of the concepts of biomimicry in indigenous culture through the study of a community in Urucurea, Pará.

2 METHODOLOGICAL PROCEDURES

- Literature review
- Visits the indigenous riverine community in Urucurea, on the banks of the Arapiuns River, in the state of Pará
- Comparative analysis of the structures of TIPITI with the snake

2.1 THEORETICAL FRAMEWORK

In Belaunde's view (2012, p. 3) "the universe originates when the anaconda sings", to scare away predators, it inflates the body and the "drawings of the meshes of its scaled skin appear." The indigenous wisdom of elements of the fauna and flora of the forests was transmitted orally. Contemporary society aims to understand how sophisticated your thinking can be. This article aims to relate it to the principles of biomimicry.

In Western zoology, boa constrictors and anacondas are reptiles. They belong to the group of scaled snakes that inhabit tropical regions and that "kill their prey by constriction, squeezing, compression" (Souza et al., 2002, p. 592 - 599).

According to a report by the Butantan Institute in the survey conducted by "herpetologist Giuseppe Puorto" in February 2022, "432 species of snakes were mapped in Brazil". Of these, only "72 are pec; and have "hollow teeth, to inject the venom." In another report, by Vanessa Sardinha dos Santos (2023, p.1), she points out, most "snake species are non-pec; and belong to the Boidae families", among them boa constrictors and anacondas.

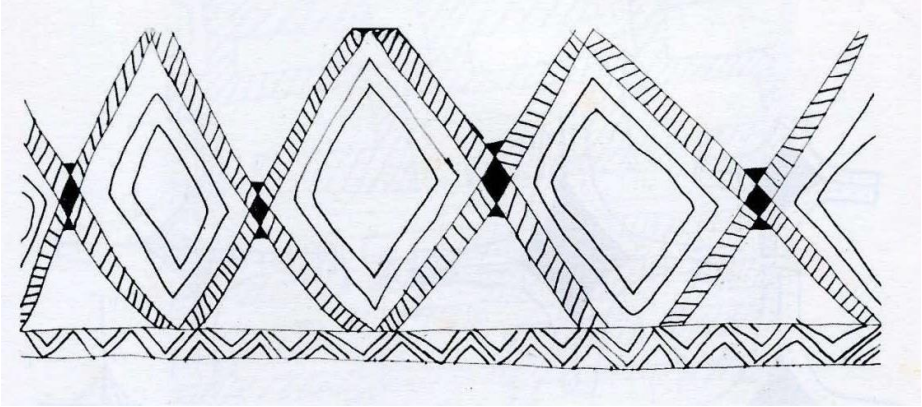
The observation; However, the behavior and particularities of these reptiles predate 1901, the date of the official opening of the Butantan laboratory by Vital Brasil, a public health scholar and creator of the anti-offdice serum. Figure 1 shows the photo of the group of boa constrictors and anacondas.

Figure 1: Photo of a snake from the boa constrictor and anaconda group Source: UOL, 2023.

The wisdom of the indigenous tribes about survival in the Brazilian territory is recognized in several sectors, especially in the Amazon region, such as the great knowledge of biodiversity, animals, plants, medicines. Another point is respect for the environment.

The tattoo, among some indigenous peoples, represents masculinity, it "allows the cac; He loves to approach animals, being confused by the smell of medicines and motifs engraved on his skin." (FUNARTE, 1985, p.68). The body paintings widely used in indigenous rituals have motifs of fauna and flora represented by means of geometric shapes, indicating the mimicry of man and the forest. As shown in the sketch in figure 2

Figure 2: Drawing on paper illustrates body painting ruraw6 - anaconda drawing



Within this scenario, it is possible to raise the hypothesis that the principles of biomimicry existed in this reproduction of the graphics of anaconda snakes transposed as adornments on the skins of men and women, as well as ceramics and fabrics of the main ethnic groups inhabiting the Xingu

Park and region. Figures 3, 4 and 5 show elements of indigenous culture with biomimetic representations and drawings with animal-based plots.

Figure 3: Tigelliform basket made of thin splints of aruma straw, dichromatic pattern with geometric motifs of mitol6gic caterpillar. Photo: D. Lamonica, Source: FUNARTE, 1985

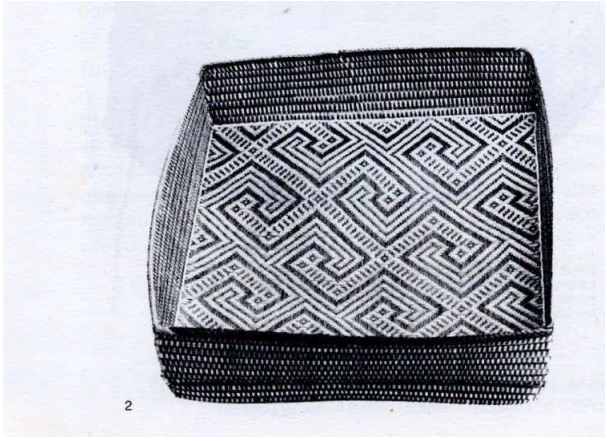


Figure 4 and 5: basketry with tucumã straw and tranr;:ado being made by the artisan from Urucurea Source: author. Photo: Marcelo Oseas, photographer accompanied the author on a visit to the community

Author Veronika Kapsali (2016) points out that the "etymology of the word biomimetic comes from ancient Greece, where bios means life and mimesis, imitac; "To this end, we are Merriam Webster's Dictionary Online (2023) defines it as "the study of formation; to the, of the structure, or function; substances and materials of biological origin; and its mechanisms and processes, seeking to synthesize similar products that mimic and imitate natural ones".

According to Forcellini (2002), the search for solutions; The concept of Bionics or Biomimicry, consists of analyzing natural systems and reproducing their principles of solution; seeking to contribute; 6es relevant in the product development process". These adaptac; Similar features allow you to create similarities in shapes, functions; and/or similar behaviours.

Through the analysis of an artifact, especially the Tipiti, it is verified that this object mimics the design, shape and mode of functioning of the snakes' body. This artifact is a type of pressing machine manufactured by the indfgens with tranc plant fibers; It is important to note that there is When

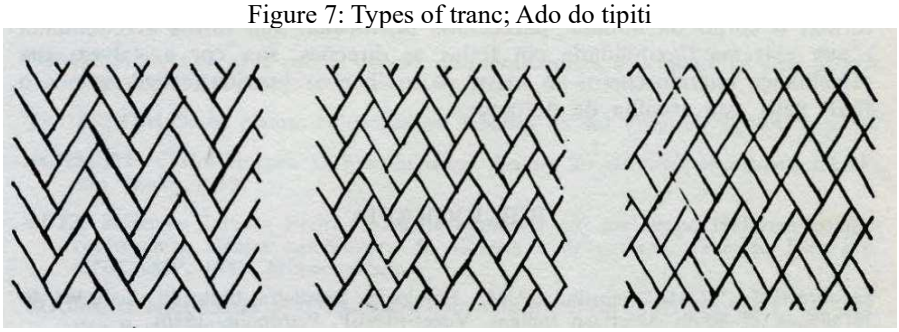
stretched, the tipiti exerts pressure on the cassava mass and its liquid, removing a good part of it. The remainder will be taken from the tables. Figure 5 represents the sketch of Tipiti.

Figure 6: Sketches of the Tipiti straw (with a diameter of about 5 cm) Source: the author

An article in the magazine of the Museu Paulista, volume XXXII, 1987, describes the forms of extract the juice from wild cassava, among which is the Tipiti, as a "slightly conical, long, tranc basket; "I think it's a good This, when empty, is very elastic in the direction of its longitudinal axis. By pulling its "length increases and its diameter decreases" and in the opposite movement, "its length decreases and its diameter increases" (Falco; Pazinatto; Ayatai 1987, p. 132).

The authors Falco, Pazinatto, Ayatai (1987) point out that using the Tipiti there is a greater efficiency of manual work, as it will be carried out with little "effort; o, eliminating cassava juice almost completely." Operating the Tipiti is part of women's work, and it is known that its strength; Physical status is reduced. Another point is that the manufacture; By the must be easy, and with local materials. In addition, there are three types of tran<; As shown in Figure 7, all of them have a triangular design.

Figure 7: Types of tranc; Ado do tipiti

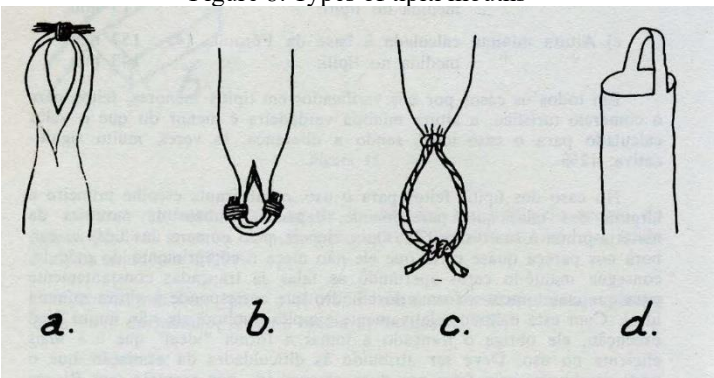


Fonte: (FALCO, PAZINATTO, AYATAI, 1987, p. (151)

According to Falco; Pazinatto; Ayatai (1987, p.150) "the morphology of the tipiti" is divided into three in the central part, and in the lower and upper extremities. The central part is longer and can be cylindrical or conical, while in the "upper part is the filling mouth and ah; a, and at the bottom the closure and al<; a. 0 module appears along the length of up to six units. The authors note that they may

have irregular shapes due to manual tranr;:ado and the shapes of the mouths and alr;:those common in the region are highlighted in figure 8.

Figure 8: Types of tipiti mouths



Fonte: (FALCO, PAZINATTO, AYATAI, 1987, p. (151)

Ávila et al. (2021, p.4) point out that cassava has its historical origins from the indigenous peoples of the Amazon. The authors note that "from historical and archaeological records, we know that the Indians have been using cassava for thousands of years and according to the oral tradition of the indigenous groups of Tupi language, a legend explains the origin of this plant"

Today, cassava has great relevance in Brazilian culture, being one of the main sources of food; among the foods, flours, gums, caxiri, cassava starch, beijus, tapioca, chibe, among other foods. The Indians also produce fermented and non-fermented beverages from cassava.

Among cassava families, there are cassava and wild cassava, as highlighted by Alves-Pereira et al. (2018, p.1) Jornal da USP, the main differences between the various varieties of cassava are in the degree of toxicity. Cassava has in its rafzes "a high level of precursor substances of cyandric acid, consumption in natura and potentially lethal."

As the authors note: Falco; Pazinatto; Ayatai (1987, p. 133), tipiti is used in the extraction of cassava juice

> Cassava, whose yield is considerably higher than that of cassava, contains a deadly poison, and the difficult extragon is not aimed at its use, but at its total elimination from the pulp. If the juice of a fruit is not completely extracted, the loss is only the fraction that remains in the fruit, but if the juice of the cassava is not well removed from the s6Iida part [...] it will contain less or more of a dangerous poison than s6 by time-consuming processes, such as drying in the sun, and cooking, it can be eliminated.

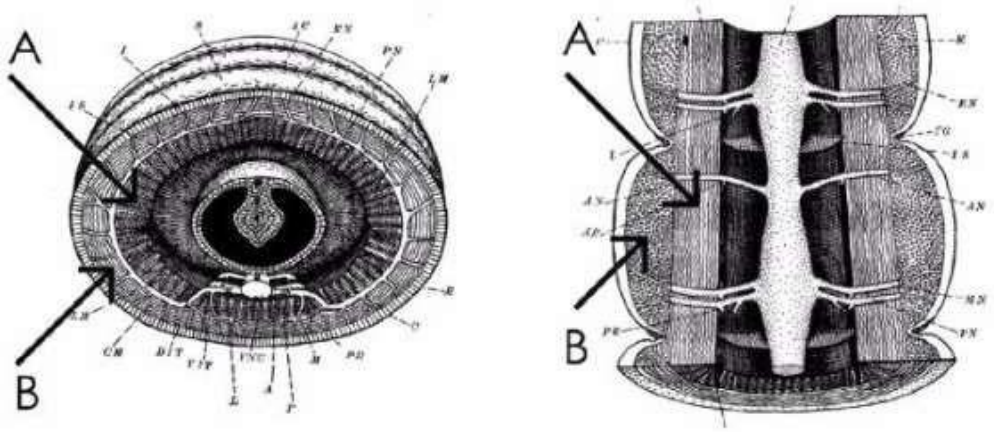
Alves-Pereira et al. (2018, p.1) observes that the process of domestication of wild cassava may have taken 9,000 years and is due to the Amazonian forests, which developed "the selection of varieties with lower levels of toxic substances, until they reached a product with minimal contents, which could be consumed practically without processing".

Other authors point out that the process becomes manual if the amount of cassava mass is small, in general, the use of tipiti or presses is dispensed with, and these are replaced by hands. Therefore, tipiti is considered a way to increase the production of flours.

The iconic aspect of this equipment may have arisen from the observation of snakes in their feeding retina and its use of a physical forga generating death by crushing, this resembles the process of extraction of cassava flake in Tipiti. Another assimilation occurs in the shape, cylindrical and long of the object, as well as the body of snakes.

Other authors hypothesize that the indfgens have observed the body of earthworms to arrive at such a solution, in the article Application of abstract formal patterns for translating natural principles into the design of new deployable structures in architecture, by M. R. Matini & J. Knippers (2008). This work evaluates a method for the transmission of natural principles to architectural structures. The author points out that "an earthworm moves by means of muscular contractions, which alternately shorten and they stretch the body." In the study, an abstract is presented; The development of movable structures in architecture, using the abstract model, as shown in Figure 9. It has been found that under the skin of the earthworm there are two main groups of muscles, the longitudinal and the circular. When the circular muscles contract, they make the worm more elongated and thinner, and when the longitudinal muscles contract, the worm becomes shorter and fatter (Figure 9).

Figure 9: Representac; to that of the earthworm's muscle groups.

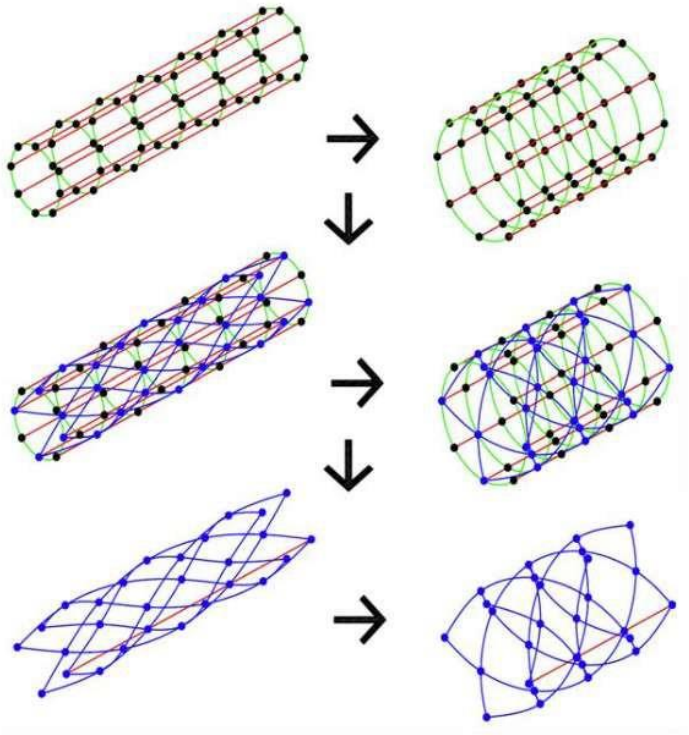


A= longitudinal muscles, B = circular muscles. Source: Matini; Knippers, 2008

The authors represented a model 30 based on deformation; Ao of the body Of earthworm graphically by parametric modeling. These raised with first It was hypothesized that the structure of the muscles was composed of two layers, one represented by red horizontal lines and the other by circular rings in green, and at the meeting of these the nodal points, in Figure 8. Curved diagonal lines in blue were inserted to the computational and physical models, producing a stronger structure, as shown in the image sequence in figure 10. Next, the authors observed that the behavior of the cylindrical model, if the horizontal lines and green rings were removed, deformac; would present

almost the same performance, due to the stiffening of the structure of the cylinders with the diagonal lines (Martini; Knippers, 2008).

Figure 10: Transformation sequence; to that of the earthworm Source: Matini; Knippers, 2008



The analysis of modeling by parameters can lead to concepi; This is a cilfndric structure, modifying the parameters of height and width. This movement of the earthworm's body resembles the use of the tipiti.

The debate points to the right; Due to the importance of Biomimicry today, some consider it a new discipline. According to the author of the text Biomimetics for Designers, Veronika Kapsa (2016), the "definitions of the principles of biomimicry have been a topic of debate in the academic communities."

As the author Kapsali (2016, p. 15) points out, "nature shows us how to achieve it; Complex systems and structures, which form interdependent relationships and feedback systems, by combining simple materials and intelligent design, using minimal resources."

According to Benyus (1997), society imitates nature, seeking, among other approaches, to minimize it; the expenditure of unnatural materials. In this sense, the forms efficient structural systems, energy systems using the maximum energy capacities of the sun, winds, these These are current paradigms. Countering the Revolui; ao Industrial,

The author points out that biomimicry is not based on "explore; to that of nature, but the search to learn from it"

3 ANALYSIS OF THE RESULTS

During a visit by one of the authors in January 2019 to the riverside community of Urucurea, on the banks of the Arapiuns River, in the territory of Pará, it was possible to collect information on the development of the river. Sabre the Amazonian riverine culture, from its way of inhabiting, to the method of construction; to that of their homes, and the basis of their food; the use of cassava as the main source of livelihood of the community living there, which is isolated for about three hours by boat; to the nearest city.

During the visit, the use of local materials was evident, such as the leaves of native palm trees, which are dried in the sun, pigmented with natural seeds and then bred; for different uses. With tucumã straw the vedac are made; On the other hand, there are TRANCs; This is similar to that used in the handicrafts produced by the community, such as baskets and rafts. The roof is made of whole leaves of the tucumã palm tree and its replacement; It takes place every six months to maintain the good tightness of the building; To. Residents today cultivate palm trees with the support of SEBRAE to avoid deforestation and reduction; to the species harmfully.

Figure 11 and 12: Photos of the riverside community's housing with closures in tucumã straw, tranga by the artisans of Urucurea

Source: author.

By following the day-to-day life of the community, the extraction process is part of their routine; In addition to the juice of wild cassava, it was possible to verify the functioning of the Tipiti artifact of the indigenous culture. In its original characteristics, as built by the artisans of Urucurea, the artifact refers to the body of an anaconda snake with its

Twisted and interwoven wefts to form a straw capable of compressing the cassava mass inside. As we can see, its body refers to the geometry of the snake's body with its wefts and translates the capacity for compression with analogous movements to the study presented in Figure 10, of the body of the earthworm.

Figure 13: Photo of the tipiti in operation, its body refers to the geometry of the snake's body with its weaves Source: author. Photo: Marcelo Oseas, photographer accompanied the author on a visit to the community

Figure 14: Photo of the tipiti in operation, extraction of cassava juice

Source: author. Photo: Marcelo Oseas, photographer accompanied the author on a visit to the community

Figure 15: Photo of the wild cassava ap6s being removed from the body of the tipiti

Source: author. Photo: Marcelo Oseas, photographer accompanied the author on a visit to the Urucurea community

Figure 16: Photo of cassava drying after 6s extract; Juice

Source: author. Photo: Marcelo Oseas, photographer accompanied the author on a visit to the Urucurea community

The edifficios of the traditional riverside architecture of Pará are inlays of symbology and great beauty with vivid colors, their fences are light to reflect the hot and humid climate of the place, the houses are elevated from the ground to avoid soil moisture. The flour houses use the Tipiti and the drying tables made of solid wood; as a basis for the making of cassava cooking processes.

4 CONCLUDING REMARKS

The definitions of the principles of biomimicry, as a new discipline, have been a topic of debate with academic communities around the world. The debate in Brazil is still little publicized, the interest of this article is to open this discussion with the question of whether the knowledge brought by the original indigenous communities is really a precedent for creation; biomimicry in the Western world.

This article analyzes the use of the Tipiti instrument, a typical artifact of the Amazonian riverine culture, added to the contemporary knowledge of biomimicry applied to design, and establishes a relationship between the two groups. With the design of the tool and the body of an earthworm and/or an anaconda snake, with similar operation, the tipiti extracts by compression the Cassava juice, the main food of this community.

According to this observation; to the one made in a visit to the community and recognition of their body paintings with motifs of snakes, of the Tranc; Made with the leaf of the tucuma palm tree for construction; From the wall and roof enclosures of their dwellings, in the making of baskets, and in the development of the c6nic body of the tipiti, it is verified that the Motives linked to the themes of flora and fauna are preponderant in the creative repertoire of this community, which makes us realize that it is created from observation; to nature.

Because it is a community of tradition<; to the mostly oral one, there is no proof<; to the writing of this past knowledge of generates<; to the in general<; However, the article does not consider reaching the conclusion of the assumptions presented, but rather broadens the research and systematizes; To the use of data, it is essential to develop its knowledge in order to prove its value in the field of design and biomimicry.

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