WOJCIECH CIEPŁUCHA[1]

THE NEVER-ENDING DWELLING IN ARCHITECTURE

NIEKOŃCZĄCE SIĘ ZAMIESZKIWANIE W ARCHITEKTURZE

Abstract

Architectural design is a process in which the architect learns the needs of future users and then transforms them into an architectural structure. Architecture emerges in discussions, sketches, in asking questions and answering them. Words are transformed into a virtual building model, and then into actual building materials.

This paper aims to present the future of architectural design. In a modern approach to design, one would retrieve information about dwelling preferences based on human biological conditions and transform the obtained information using modern digital tools into a model of an architectural structure for users, and for their place of dwelling. There would no longer be avant-garde, but architecture of personality.

Keywords: dwelling, personality, bird nests, termites, digital world, tradition, modernity

Streszczenie

Projektowanie architektoniczne to proces, w którym architekt poznaje potrzeby przyszłych użytkowników a następne przekształca je w strukturę architektoniczną. Architektura pojawia się w dyskusjach, szkicach, zadawaniu pytań i odpowiadaniu. Słowa przekształcane są w wirtualny model budynku a ten w materiały budowlane.

Niniejsza praca ma na celu przedstawienie przyszłości projektowania architektury. W nowoczesnym podejściu do projektowania, pobieralibyśmy informację o preferencjach zamieszkiwania z uwarunkowań biologicznych człowieka. Uzyskane informacje przekształcilibyśmy dostępnymi nowoczesnymi cyfrowymi narzędziami i stworzyli model struktury architektonicznej dla użytkowników i ich miejsca zamieszkiwania. Nie mówilibyśmy już o awangardzie, mówilibyśmy o architekturze osobowości.

Słowa kluczowe: zamieszkiwanie, osobowość, gniazda ptaków, termity, świat cyfrowy, tradycja, nowoczesność

1. INTRODUCTION

Architecture of personality is about creating space to meet the user's needs. Ideally, the space could be changed by pushing buttons, thus changing the ambient atmosphere, creating it especially for the user.

Observing architecture, one observes the needs, and responses to them in the form of buildings. Understanding why a building looks as it does is understanding the client's needs and the architect's response to those needs.

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Observing the architecture of the last century, we see architecture shaped by culture and tradition, i.e. people who went through certain past events that shaped them. Therefore, should architecture be created with a tradition? One should answer the question how much tradition there is in the modern world, how much of the old there is in the new, how many old habits in the modern construction. One needs to consider which habits to leave, and what habits are new, which needs for dwelling are new?

The architectural structure emerges in discussions, sketches, in asking questions and answering them. It is explained in the form of words. Words are transformed into a sketch, and then the expressed needs are transformed into an architectural structure. Design decisions are influenced by the building tradition of a given region, as well as investor's guidelines and knowledge of the architect and other people involved in the design and construction process.

Literature mentions human qualities that result directly from genotype and phenotype. The phenotype includes both the acquired qualities and genotype the ones that are passed down from generation to generation. The information contained in both the genotype and phenotype is important. In architecture, the qualities of appealing space result from one's place of birth, or social affiliation.

The aim of the paper is to present the possibilities of shaping architecture not by design methods but by biology. Bird nests, cobwebs and termite mounds are constructions that are a shelter, place of rearing offspring, a hunting ground or storage for animals and seemingly have little to do with man. However, people also have preferences written in their DNA and proteins about the space, in which they feel comfortable, and which they feel is desirable for them. Modern technologies offer powerful computing, which, combined with research of many scientists, will allow getting closer to creating architecture straight from the human *ego*.

2. THOUGHTS ON THE CREATIVE PROCESS

It is important that architecture is being created, instead of has been created. Life is continuous, so architecture should be created continuously.

A house should be built, and grow or wither like a plant, because life changes.

In its atmosphere, architecture should not only respond to human needs, but provide feedback to human needs. If one is sad, architecture should be joyful, if one is overjoyed, it should calm one down.

It should allow people to cross the street straight off the sidewalk, without waiting for the red lights.

It should protect them from rain if they just want to admire the reflections in the puddles on the square floor, allowing a stroll under the arcade.

It should offer sunshine only when they need it, and not exposing them to scorch for the lack of shade.

3. NATURE WORLD

In nature, there are many natural constructions. This paper will discuss bird nests, cobwebs and termite mounds. These three constructions are "homes" for the animals, and are created due to evolution and the cleverness of organisms. They were built using local materials mixed with

gland secretions of the animals form a strong structure. E.g. birds use them to store their eggs, and protect them from damage. The spider's "house" is its hunting ground. A properly woven silk thread structure creates a barrier for the prey, which gets caught in it, and eaten. The less visible the spider is in its house, the cobweb, the greater the chance that it will catch its prey. Termites use their building and organizational skills to create space for breeding and mushroom farming, up to 7 m below ground level. The key to success is proper ventilation system of the construction, a network of successive corridors and chambers with various functions.

3.1. BIRD NESTS

Bird nests are diversified in terms of design by different families, offering different functionalities. They serve primarily as a place to nest and incubate eggs, and a safe place for rearing offspring. It is assumed that the nests integrate parts with specific physical and mechanical properties, evolutionarily selected to provide comfort, sexual signaling, defense against parasites or pathogens, and thermal regulation. *This suggests that nest construction is governed by specific production programs, while materials are deliberately selected for specific roles. However, the deliberate selection of materials for specific functions in bird architecture must still be fully explored.*[2] Birds that build nests from scratch collect and combine materials using different construction methods that can be divided into stacking, forming, gluing, braiding, sewing and weaving. The purpose of various techniques is to provide solid fixing of the construction, and its sturdiness. Some materials hold due to their inherent properties (e.g. mucus), while others require some structural connections (e.g. branches). Several studies have attempted to determine the factors affecting the biomechanical characteristics of the nest, studying building materials and architecture.

A less laborious way to make a nest is to use a cavity that already exists. Many birds, including owls, use natural holes in the trees as a ready place to raise their young. Other birds, such as starlings and sparrows, have learned to use holes in the roofs to create nests. After choosing a nesting site, bird intervention is still required. Creating a lining, however, is less laborious.

3.2. SPIDER WEBS

A spider's web is made of silk. Apart from spiders, other arachnids and larvae of many insects produce webs. Sophisticated constructions are built from spider silk, e.g. hunting nets, cocoons, girdles, security threads, gossamer and even underwater chambers.[3] Spiders build their web in different ways. It depends on the species and purpose of the network. Some hunting nets have the form of a vertical, horizontal or diagonal plane. The basic role of such networks is to create a fishery site. As for birds, it's about creating a home for chicks, so here is about creating a place to catch. The birds mate to raise small. Spiders, on the other hand, create communities that build networks together. Such networks have many square meters. They consist of hundreds of connected sheets, creating a common tool for hunting and dwelling.

The house of the spider also has another meaning, in addition to the place of residence and fishing. It is food for birds and chicks. The spider's web is also used by flaps to build nests. Birds use nets to connect the material, glue the branches and fix the nest to the ground.

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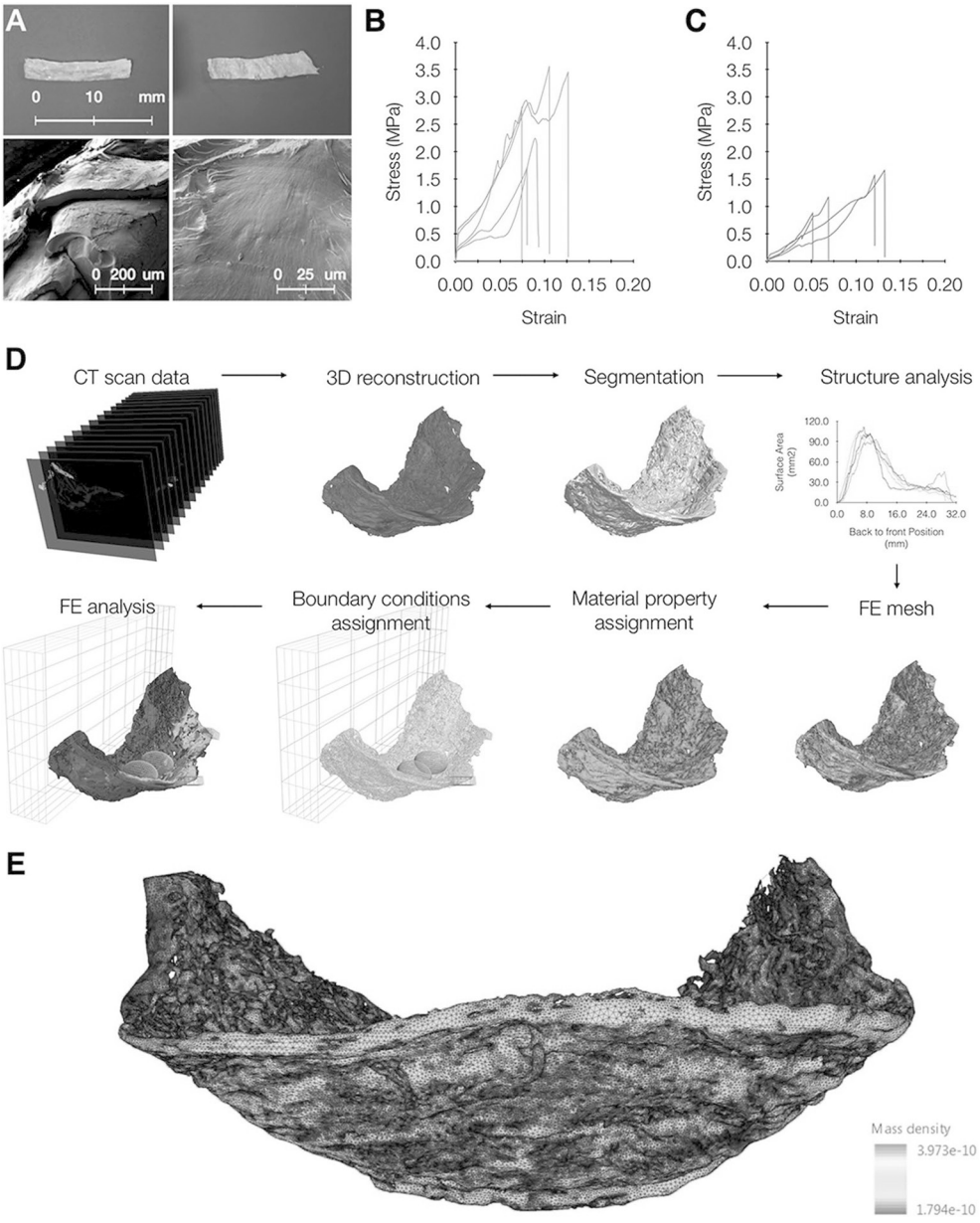
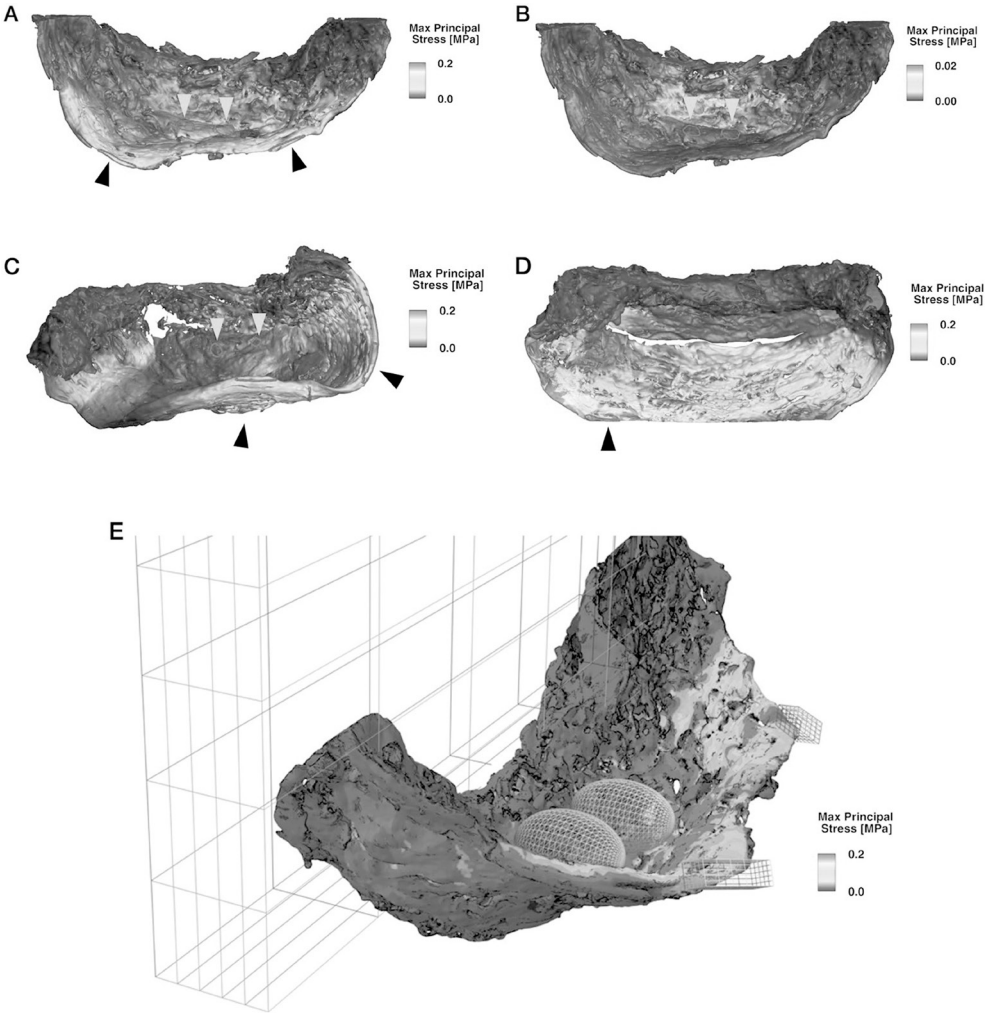
[2] H. R. Jessel, S. Chen, S. Osovski, S. Efroni, D. Rittel, I. Bachelet, *Design principles of biologically fabricated avian nests*, Scientific Reports, 2019, Vol. 9, no. 1, pp. 1–9.

[3] M. Żabka, *Jak pająki snują sieć?*, Świat Nauki, 2018, Vol. 04.



Ill. 1. Mechanical characterization of nest material. Source: Jessel H. R. [et al.], *Design principles of biologically fabricated avian nests* (2019)



Ill. 2. Finite element simulations results showing the maximum principal stress at the end of each linear static loading scenario. Source: Jessel H. R., *Design principles of biologically fabricated avian nests* (2019)

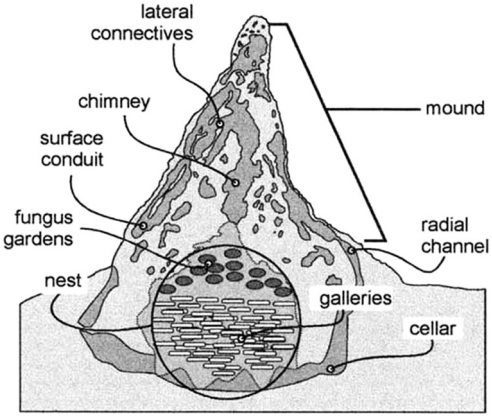
Chaffinch, which nests in tree forks, uses sticky webs to make pads on branches that anchor the nest foundation.

Finally, they fill the nest bag with feathers to it them warm and soft. Studies have shown that long tailed hens can use up to 2,000 feathers for each nest, and fly 600–700 miles to gather different materials! Spider webs are an essential part of the design of these hanging nests, which demonstrates how closely linked the birds and spiders are.[4]

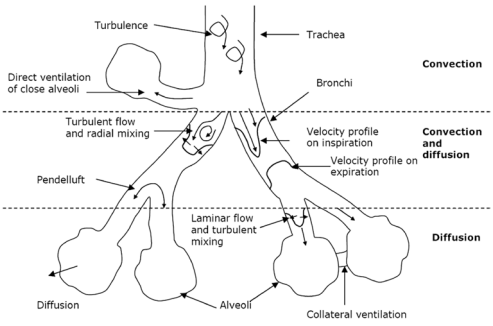
[4] https://www.rspb.org.uk/birds-and-wildlife/natures-home-magazine/birds-and-wildlife-articles/features/home-sweet-home/#TrTeFHWebDSOPJ9C.99.

3.3. TERMITE MOUNDS

The fungus cultivating termites, Macrotermes, build incredibly thought-out architectural structures. Termites form their kingdom, which is a flat, shelter, mushroom growing place and breeding place for them. Such large structures have a suitable construction and ventilation system. Mounds can have different forms depending on whether they are in savannas or in tropical forests. However, despite the fact that they are created by different termite communities, in different places, termite nests have similar interiors. Termite mounds occur in tropical and subtropical regions of Africa, Southeast Asia and Australia. *There are two main types of termite mound, according to Noirot, open ventilation mounds in which chimneys or holes in the sides of the mounds allow air to flow into or out of the mounds due to differences in wind velocity, and closed mounds in which no holes or chimneys exist, but where gases are exchanged through a porous outer layer.*[5]



Ill. 3. Diagram of termite mound structure (Turner, 2001)



Ill. 4. High frequency lung ventilation showing different gas exchange and mixing mechanisms. From Slutzky and Drazen (2002)

Termites move during the period of their lives, so you can not say there is one central place in the mound. The larvae are transferred from place to place and there is no single reproductive chamber. When creating their mound, termites follow moisture, sometimes along buildings or walls, just like tree roots. *The nest is surrounded by a network of tunnels that merge to form a central chimney. The chimney extends to lateral connectives, which feed vertically oriented surface conduits. A porous Surface covering separates the surface conduits from the outside air.*[6]

Weir measured the ventilation in openchimney mounds of the Macrotermes subhyalinus and it was concluded that flow was induced by the wind passing over the open chimneys and drawing air in from openings nearer the base of the mound. However, it is now thought that these simple models do not adequately describe the ventilation and gas exchange process-

[5] Worall M., *Homeostasis in nature: Nest building termites and intelligent buildings*, Intelligent Buildings International, 2011, Vol. 3, no. 2, pp. 87–95.

[6] *Ibidem*.

es in a termite nest.[7] Naturally shaped ventilation in buildings for humans is also of great importance. Following modern technologies, we forget about the classic approach to design. Being naturally in a building is of great importance for the well-being and way of working of a person. Modern shaping of space and facades should meet the needs of the user and not require him to change.

4. A BRIDGE BETWEEN THE NATURAL AND THE DIGITAL WORLD

High computing power allows quickly verifying multiple possible project versions. Bioinformatics is a science, which is a bridge connecting digitization with human nature. Thanks to programs and results in databases, one can obtain information about the needs of the region's society in a given time frame. Such information will help in designing architecture, as the accumulated multi-generational knowledge will help to obtain a building form that is better suited to the individual preferences of the user.

Bioinformatics can be considered as a bridge between life science and computer science. Biology requires high and large computing power for biological applications and to access huge number of distributed and (often) heterogeneous databases. Computer scientists and database communities have expertise in high performance algorithms computation and in data management. Considering bioinformatics requirements, in this paper we present PROTEUS, a Grid-based Problem Solving Environment for bioinformatics applications. PROTEUS uses ontology to enhance composition of bioinformatics applications. Architecture and preliminary experimental results are reported.

5. CONCLUSION

Because of construction tradition, it seems that the building remains unchanged after construction. One can possibly move the windows, or open the door, or slide the balcony door. Or, water and gas equipment operates, moves and transfers substances in the building. But shouldn't it be that the building changes with us and our mood? One could imagine the relationship between the building and our needs at the moment, or the needs spread over a longer period of time. For example, in adolescence one eagerly runs up the stairs, swings on the kitchen swing, stands on the table, and in the old age, when one chooses shower over a bathtub and reluctantly walks the stairs, is slower in many activities and would rather less move around the house and have everything at hand.

Birds create nests in accordance with tradition and nature, as shaped by evolution. Interestingly, these elements of the modern world seem to have influenced the form of nests and the ways of creating them. In the past there were no buildings like now, they are different, the architecture has evolved thanks to technology, prefabrication, and new ways of building. So also the birds and their nesting method changed. It is influenced by the new conditions surrounding them and the situations they face. Observing nature, we learn more about ourselves, our humanity and our ways of being.

[7] *Ibidem*.

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