

The Electronic Campus: An Information Strategy Proceedings Of A Conference Held On 28-30 October 198

3rd International Conference on New Trends in Architecture and Interior Design
APRIL 28-30, 2017, HELSINKI, FINLAND
PROCEEDINGS BOOK
RESILIENT MATERIALS AND STRUCTURES EMULATING
NATURAL ORGANISMS

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Abstract

Materials always reflect the physical effects of a space; they are skins of spaces both internal and external. Materials are not only used for gaining visual characteristics of a space but also to create healthy environments, which means air quality, lighting quality, or ergonomics of a space. Structures that create these spaces are important elements of defining tangible skins of spaces such as wall, floor and roof coverings. On the other hand, they have a high impact on energy consumption, carbon footprint and indoor air quality due to production and usage processes. Thus, a need for producing resilient materials and structures has developed. However, emulating such materials and structures need a sustainable approach such as biomimicry. Biomimicry is a new field of science that embraces strategies, ideas and solutions from living or nonliving organisms of nature, and aims to use them to solve challenges in human life, manage them successfully, and create sustainable environments. Since the existing condition of the earth is not healthy in terms of carbon footprint, energy consumption, and environmental pollution; then it means there is a necessity for flexible materials and structures to minimise, perhaps prevent, these negative impacts. Nowadays, architects research to develop materials that are more flexible, self-healing, growing, and decomposing just like organisms in nature [1]. Besides, engineers and architects are working on structures inspired by nature that could make buildings more resilient and durable. As it is known that the construction industry is one of the largest fields that has a negative impact on earth, therefore it must be reduced to create better sustainable environments for future generations.

This paper analyses some of the most important resilient materials and structures derived from nature and evaluates their physical effects on architecture, indoor environment and structural behaviour of buildings. It also emphasises and describes how principles of biomimicry have led the way on emulation of these materials and structures. Additionally, the paper draws attention to importance of how nature's genius can help to save the earth.

Key Words: resilient; nature; biomimicry; structure; physical effect.

1. Introduction

Spaces may leave either a positive or negative impression on users when they are constructed with various materials. This not only affects the psychological behaviors of users but also the environmental conditions both inside and outside. When it is mentioned as inside, it means the indoor air quality of a space and when it is outside, it means the environmental pollution including carbon footprint, air pollution, etc. Walls, floors and ceilings –including surfaces of furnishings– are tangible skins of a space. They are supposed to be designed as healthy architectural elements. However, large group of materials that are to be used when designing these spaces, are not completely harmless. These materials are either less harmful or more chemically produced; either ways are bad. William McDonough writes "*Less is not good*" in his book *Cradle to Cradle*, to clarify that producing materials that are less harmful or less chemical are not helping earth to heal [2]. He emphasizes the importance of producing materials with zero waste or become raw materials for other goods at the end of their life cycle. This is the fact that the construction industry should seriously consider this issue when producing materials.

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