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Aspects of environmental comfort and sustainability in the built environment

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ABSTRACT

The objective of this article is to bring to discussion aspects of environmental comfort, built environment and sustainability, given the climate crisis and the urgency to find solutions to the issue. The concepts of ambience, quality of the built environment, environmental comfort and sustainable development are discussed, in addition to principles that can guide Architecture in its search for a built environment that preserves comfort through sustainability. The method used is bibliographical review, and the paper concludes by affirming that while it is not possible do determine the extent to which sustainability principles applied to the built environment can contribute to tackling the climate crisis, there is no other alternative.

KEYWORDS: Environmental comfort. Built environment. Sustainability.

1 INTRODUCTION

All human activities depend on a built environment that provides suitable conditions, including the appropriate degree of comfort. Producing and maintaining the built environment, with the necessary conditions for it to be able to provide comfort to its users, implies the consumption of large amounts of natural resources, water and energy, the generation of a high volume of waste, and therefore, significant environmental impacts.

Currently, the world is experiencing the climate crisis, whose effects are increasingly leaving the terrain of probabilities to become reality. For some time now, there has been a need to modify, along with all other activities, the way to produce, maintain and use the built space and its conditions to generate comfort. Efforts have been made in this direction, as in other fields of activity. While these efforts are believed to have helped alleviate the seriousness of the problem, the current circumstances do not seem to indicate that this is being enough.

This article aims to discuss some aspects of environmental comfort in the built environment in the context of the climate crisis. Issues such as the quality of the environment, environmental comfort, sustainable development, and sustainable principles for the production of built space, considering comfort conditions, are addressed. The method used was bibliographical review, based on which we present the discussion on the topics above.

In conclusion, although it does not seem possible to determine the extent to which adherence to sustainability principles in the production and maintenance of the built environment and its comfort conditions is contributing to tackling the climate crisis, there is no other visible alternative but to move forward in adhering to such principles.

2 THEORETICAL FRAMEWORK

2.1 Environmental quality and ambience

For Paes (2016), the issue of environmental quality in buildings is related to several other fields of knowledge, and it encompasses both objective and subjective aspects. Thus, it is possible to approach this topic in many ways. This author proposes that analyses on this issue should start with the concept of Ambience, and presents the definition used by the Ministry of Health of Brazil (2010), noting that, although the agency uses it to promote the humanization of health spaces, it is applicable to any building.

For the Brazilian Ministry of Health, the concept of ambience transcends the technical and formal aspects of the environments, as it takes into account situations built in a specific space and time, that are experienced by a group of people through their cultural values and social relationships. This concept underscores the elements of the environment that interact with users (color, odor, sound, shape, light), comfort, the possibility of producing subjectivities through the encounter between people, and the space's capacity to facilitate activities performed in it (BRAZIL-MS, 2010).

In Paes' (2016) view, taking into account the symbolic and psychological meanings of space allows the qualitative expansion of the Cartesian concept, which is limited to the dimensions and physical characteristics of the environment. Thus, a building can be understood as a spatial artifact endowed with both symbolic and utilitarian values, which derive from the experience of space itself. For Keeler and Burke (2010), the level of comfort and efficiency experienced in indoor spaces is associated with users' psychological and physiological reactions to the characteristics of the architectural design, and the terms they use to designate this association are indoor environment quality, or building ecology.

2.2 The environmental comfort

According to Lamberts et al. (2013), environmental comfort can be defined as the set of environmental conditions that provide human beings with thermal, acoustic, visual and anthropometric well-being, in addition to ensuring air quality and olfactory comfort. Although the climate can vary depending on the region of the planet, human beings are biologically similar, and capable of adapting to different climatic conditions through clothing, architecture and technology.

For Lamberts et al. (2013), the importance, in particular, of the variables of thermal and visual comfort aspects lies in their strong correlation with energy consumption. Thus, the authors define the energy efficiency of a building as its potential to provide thermal, visual and acoustic comfort to the user through low energy consumption. Therefore, it is possible to say that a building is more energy-efficient than another when it provides the same environmental conditions with a smaller consumption of energy (LAMBERTS *et al.*, 2013).

For Corbella and Yannas (2009), the feeling of comfort related to a phenomenon occurs when a person can observe it without worry or discomfort. Therefore, a person will be in a comfortable physical environment when he or she feels neutral towards it.

Thermal comfort is achieved when the skin temperature maintains the flow of body heat loss at the optimum level, thereby causing one to feel thermally neutral. This sensation depends on the combination of climatic factors (temperature, humidity, wind, solar radiation etc.) and individual characteristics (weight, age, clothing, activity etc.) (CORBELLA; YANNAS, 2009).

In turn, visual comfort is related to being able to see well, which depends on the suitable level of light for the task to be performed. There are norms, which are defined according to the type of task, the degree of precision required, the age of individuals and the type of environment. Aspects such as the existence of glare, the distribution of light in the environment and the surface colors are also important. For a design that aims to take advantage of natural

light, it is necessary to have as much information as possible about the characteristics of the sky. And to avoid energy waste, the design must combine natural and artificial lighting (CORBELLA; YANNAS, 2009).

A built environment is considered to have good acoustic comfort if its architecture does not hinder its users' ability to hear well. The sound level must be adequate, in addition to having no absorbent or reflective surfaces may cause deformation, reverberation or interference. External noise should also not interfere with the sound that should be heard, and it is of great importance that the design consider the effects of urban noise and other sources of noise on the surroundings (CORBELLA; YANNAS, 2009).

According to Agopyan and John (2011), in developed countries, since the 1950s, buildings with glazed facades began to be built, which are highly dependent on artificial environmental conditioning systems. In the 1960s, to counter this building standard, Bioclimatic Architecture began to be developed (AGOPYAN; JOHN, 2011) with a concern for its integration with the local climate and its impact on the planet, but also with a focus on the environmental comfort of the human being (CORBELLA; YANNAS, 2009).

Corbella e Yannas (2009) also consider that the first oil crisis, in 1973, fostered the so-called solar architecture, whose main concern was to save fossil energy consumption, by incorporating solar energy to help feed the heating systems of buildings. For both authors, as a result of this movement, Bioclimatic Architecture gained new impetus.

2.3 Climate crisis and sustainable development

Today, Science affirms that the global climate is in crisis, due to human action. Activities such as burning fossil fuels, deforestation, changes in land use, livestock, landfilling, the use of nitrogen-based fertilizers, and cement production, among others, have enormously increased atmospheric concentration of certain gases, which trap the heat given off by the Earth's surface, thus raising the temperature across the planet. The main causes of this phenomenon, known as the Greenhouse Effect, are carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). As a result of this process, extreme weather events, including floods, heat waves, and large fires, are becoming increasingly frequent and intense (NAS; ROYAL SOCIETY, 2020).

There is no easy solution to the climate crisis, and addressing it requires changes to humanity's current way of life. New technologies, new behaviors and public policies will be required, which allow economic activity to reduce embodied carbon and resource waste, while increasing energy efficiency and the use of alternative energy sources, and preserving forests (NATIONAL GEOGRAPHIC, 2019).

The Club of Rome, created in 1968, gathers distinguished scientists, economists, business and political leaders, whose objective is to define comprehensive solutions to interconnected global problems, whether environmental, economic, political or social (CLUB OF ROME, 2021). In its book titled “The Limits of Growth”, released in 1972, the Club of Rome argued that world population, industrialization, pollution and depletion of natural resources were increasing exponentially, while resource availability increased linearly, which could lead the planet to collapse. The concept of sustainable development, as formulated by the

Brundtland Commission in the following decade, had its origins in that period of great pessimism about the future (AGOPYAN; JOHN, 2011).

In 1983, as a reaction to this scenario, the UN created a Commission to analyze the problem, and Gro Brundtland, the then Prime Minister of Norway, was appointed the commission's president. In its final report, released in 1987, the Commission presented its concept of sustainable development, based on the use of natural resources to satisfy humanity's present needs, while preserving the potential of the environment to meet the needs of future generations (AGOPYAN; JOHN, 2011).

In the following decade, at the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992, the Climate Convention, the Convention on Biodiversity and Agenda 21 were adopted, containing comprehensive recommendations on sustainable development, which had great influence on the world in several areas. In its broadest sense, the concept of sustainability reconciles environmental, economic and social aspects, forming a triad that must be considered in an integrated manner, as the only way to achieve sustainable development (AGOPYAN; JOHN, 2011).

2.4 Environmental comfort, built environment and sustainability

The transformation of the natural environment into a built environment, as well as its permanent updating and maintenance, are activities carried out by the civil construction production chain, which account for the use of large quantities of construction materials, labor, water, energy, and waste generation, and for major environmental impacts (AGOPYAN; JOHN, 2011).

Developing an architecture capable of providing environmental comfort to users, without relying on energy for air conditioning, is a challenge for today's architects. Since the dawn of civilization, humans have been seeking to adapt their protected spaces to the topography, vegetation, climate, thus building a modified space capable of providing comfort, in the broadest sense of the term to the human being (CORBELLA; YANNAS, 2009).

According to Gelpi and Kalil (2015), urban life in cities of the 21st Century have put a great distance between mankind and nature and its seasonal cycles, thus making cities and buildings more and more disconnected from landscapes and places. Based on this observation, numerous studies were carried out with the aim of developing construction and maintenance technologies and applying them to urban buildings capable of reducing environmental impacts in the use of natural resources, thereby saving energy and preserving the environment (GELPI; KALIL, 2015).

For Gauzin-Müller (2011, apud PAES, 2016), environmental quality is an association of human comfort with the sustainable use of natural resources and the control of waste, which, applied to architecture, introduces new requirements in the production process of buildings, and demands changes in the behavior of architects and users.

Paes (2016) considers that environmental quality is part of the issue of buildings' sustainability, and is related to all dimensions of it. Design decisions, whether referring to objective or subjective aspects of the built environment, have consequences that directly affect the performance of the building in the energy, environmental, sociocultural and economic

aspects of sustainability. The building must incorporate sustainability requirements, values and guidelines throughout its life cycle, from conception to demolition. This concern can be summarized into principles such as conscious use of resources, reduction of pollutant emissions, promotion of users' health and comfort, harmony with the surroundings, cost reduction and improvement of the community sociocultural level (PAES, 2016).

According to Edwards (2004), taking into account buildings' average lifespan (which can reach a century), buildings built today will exist in a very uncertain future in terms of climate and of resources availability. Some basic guidelines can be followed in order to make new buildings more flexible and optimized: avoiding functional exclusivity, maximizing access to natural light and ventilation, prioritizing simplicity and functionality in installations and construction systems, seeking maximum quality and durability in construction, and providing maximum access to renewable energy sources (solar, wind, geothermal or hydroelectric) (EDWARDS, 2004).

Still regarding Bioclimatic Architecture, Corbella and Yannas (2009) say that a good architectural design must take into account all aspects of comfort, as well as everything that happens in the external environment. For them, there is no sense in providing good thermal comfort if the consequence of the architectural concept will be visual or acoustic discomfort. Thus, the solutions must be integrated so as to provide a good level of environmental comfort in an comprehensive way.

Corbella and Yannas (2009) consider that Sustainable Architecture is the natural continuity of Bioclimatic Architecture, as it tries to make the building a part of a larger whole, thus integrating it with the entirety of the environment. For these authors, Sustainable Architecture wants to create buildings to increase the quality of life of human beings in the built environment and its surroundings, through integration with the local way of life and climate, consuming the minimum energy necessary for environmental comfort, as a way to bequeath a less polluted world to future generations.

3 CONCLUSIONS

The comfort and quality of the environment are complex attributes. Achieving them depends on an arrangement in which a series of variables (thermal, acoustic, luminous, ergonomic and sanitary) combine to provide well-being, but not only that. According to the concept of ambience, symbolic and psychological meanings, that result from the experience of the users of particular space, also contribute to the result.

Considering that energy efficiency is a current imperative, the relationship between environmental comfort and energy consumption comes to occupy a central position. And this implies adding more complexity to an issue (environmental comfort in the built environment) which, as mentioned, is already complex.

If the construction of a modified space, capable of offering comfort to human beings, and of preserving harmony with the natural environment is a primordial pursuit, then Architecture must not stray from it. It must not lose sight of principles such as respect for surroundings, reduction of energy and natural resources consumption, reduction in the generation of waste and pollutants, promotion of users' health and comfort, use of natural light

and ventilation, prioritizing simplicity, functionality and durability, and the use of renewable energies, among others. While it is not possible to determine the precise extent to which adherence to these principles is contributing to alleviate the climate crisis, there is no alternative path. So all that is left is to move forward, full speed ahead.

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