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OMFORT IN THE ENVIRONMENT BUILT: TECHNIQUE, AMBIENCE AND SUBJECTIVITY

ABSTRACT

The present work aims to contribute to broaden the discussion about issues that involve the aspects related to environmental comfort in the built environment and its derivations, understanding the environment as place of participatory actions by its users. This study addresses the notion of comfort seen under two main aspects: initially, the most common, under a more pragmatic and technical content, from the basis of generating norms, and standards, then, under a prism rarely associated with the field of comfort, a more subjective, naturally embodied by users, and finally emphasizing the work of the contemporary architect Peter Zumthor. The study sequences its development studying the main normative sources such as the Technical Standards and Quality applied to the built environment, and discusses the thought of several contemporary professionals dedicated to the questions here listed. Finishing with an approach on the thought of Peter Zumthor, the study exposes, contributing to the discussion of the theme, the dichotomies that still exist on the approaches and opens the way for future research.

KEYWORDS

Environmental comfort. Sustainable development. Spatial experience.

O CONFORTO NO AMBIENTE CONSTRUÍDO: TÉCNICA, AMBIÊNCIA E SUBJETIVIDADE

RESUMO

O presente trabalho tem como objetivo contribuir para ampliar a discussão sobre as questões que envolvem os aspectos relativos ao conforto ambiental no ambiente construído e suas derivações, compreendendo o ambiente como lugar de ações participativas por parte de seus usuários. Neste estudo, é abordada a noção de conforto vista sob dois principais aspectos: inicialmente, o mais comum, aquele de um olhar de conteúdo mais técnico, pragmático, a partir das bases geradoras das normatizações, e, em seguida, sob um prisma raramente associado ao tema conforto, de caráter mais subjetivo, atento às sensações dos usuários, com ênfase final na referência à obra do arquiteto contemporâneo Peter Zumthor. O trabalho sequencia seu desenvolvimento estudando as principais fontes normativas como Normas Técnicas e Selos de Qualidade aplicáveis ao ambiente construído, e aborda o pensamento de diversos profissionais contemporâneos dedicados às questões aqui elencadas. Finalizando com uma aproximação ao pensamento de Peter Zumthor, o trabalho expõe, contribuindo à discussão do tema, as dicotomias ainda existentes nas abordagens e, se indaga, abrindo caminho a pesquisas futuras.

PALAVRAS-CHAVE

Conforto ambiental. Desenvolvimento sustentável. Experiência espacial.

INTRODUCTION

"The architect must deal with light, sound and heat as a problem of his own" ¹.

Today, when addressing issues related to environmental comfort, there is a great deal of association with regulations, qualifying seals or the use of equipment and techniques capable of modifying the conditions of built environments, such as air, heaters, solar collectors, among other equipment. However, does these standards, certifications and equipment, by itself, assure the quality of the user/environment connection in different physical, social and geopolitical situations?

In his doctoral thesis, Silva (2009) ponders about the technical and construction changes, where it is increasingly important to control the main impact on the comfort of users built environments. According to Silva (2009, p.1):

Over time, with the evolution of man's knowledge of the interior and exterior environment of the building, with increasing construction complexity, increased demands of occupants and technical development, other requirements were gradually added to that which are already known [...], with the question of comfort being hygrothermal, visual or luminous, olfactory or acoustic, valued, since it is necessary to guarantee the health, well-being and comfort conditions of the occupants.

¹ Kahn (1950), (apud GONÇALVES, 2001, p.273). Louis Isadore Kahn (1901-1974) was one of the most prominent architects of the twentieth century.

Although not explicit, the idea of comfort in architecture and urbanism always permeated the treaties, reflections or even the projects designed by renowned architects since ancient times.

It is known that these thoughts reflects its time (vary depending of the authors) and reveal, not only the physical/technical point of view, but also in some specific cases, environmental concerns, health and well-being of the occupants of buildings and towns, marks and guidelines for strokes and occupation of environments, especially when they design new urban settlements.

Somehow, the notion of comfort is still widely understood as a quantitative question of the environment regarding air conditioning, lighting, solidity and quality of the materials, i.e., something that is out of our bodies, our actions with/about place.

On the other hand, appears in the middle of the 20th century, a new look at the idea of environmental comfort, where the inhabitant is the protagonist in the environment, as a person now able to go a little further than receive passively the effects of equipment, designed the get optimum conditions of comfort. We can see schematically these two approaches in Figure 1.



Figure 1: Two approaches scheme.
Source: Authors.

In his article, Segawa (2003) shows that concerns about the comfort are not new in the field of architecture, and neither are seen from the same standpoint. According to Segawa (2003, p. 37-46):

It is possible to identify these different ideals, from Antiquity to Enlightenment, in the context of the expansion of geographic and climatic horizons at the beginning of the Modern Era by the end of the 19th century, to show the specificity of human confrontation with adverse climatic conditions as a scientifically systematized matter in response to the problematization posed by colonialism and salubrity.

Rheingantz (2001) not only confirms the existence of concerns regarding comfort since the dawn of man's dwelling, as points out that from the middle of the 20th century, new technologies that allowed a detachment of comfort and its direct relationship with the environment of which is inserted. According to Rheingantz (2001, p. 35-58):

Although the environmental comfort has been structured as discipline only after World War II, its principles have emerged in prehistory, when the man found out, in the cold seasons, it was convenient to dwell in caves with the opening targeted to the direction of the Sun's rays. While power availability was restricted, the use and application of the resources available was optimized, that maximized and produced an architecture in perfect harmony with the climate and cultural values. The technological and scientific development experienced from the World War II takes the man to believe that it could take "control" of the planet, and build air-conditioned environments, in order to highlight their "victory" over the nature. The new buildings are treated as objects which should create inside them, artificially, a comfortable temperature, where predominates the design focused on building as aesthetic object devoid of historical context, which prioritizes the graphic schemes determined by zoning, uses and function.

In Segawa (2003) and Rheingantz (2001) it is possible to verify that the evolution of the concept of comfort, combined with the historical and technological processes, allowed/induced that this notion was treated independently from the environment, nature, where, tacitly, receives the parameters to be used.

This decoupling between comfort and environment, which currently can be perceived as natural, including the use of standards and universal concepts that has established *optimal* relation of climatization, sound and luminous, indexes leading to an understanding of the idea of comfort as a user's neutrality in relation to the environment.

Oscar Corbella and Simos Yannas (2003) in their excellent work on architecture in the tropics, yet assuming that independence, insert the user as a passive subject in the environment, as the procedures to promote technical solutions will solve the possible annoyances caused by adverse weather conditions.

Corbella and Yannas (2003) says that the condition of comfort (thermal), is directly linked to the body's temperature (35° C) and the *ideal* conditions of the relationship between the temperature and the relative humidity of the air, which are called Comfort Zone. According to Corbella and Yannas (2003, p. 30):

A person is comfortable with an event or phenomenon when you can watch it or feel it without worry or hassle. Then it is said that an individuals are in a physical comfortable environment when they feel neutral about it.

If on the one hand it is apparent that the placed thought by Corbella and Yannas tends to a more general look of concepts (although applied to regions of the tropics), on the other hand, one can understand that, in addition to the references, there are physical factors (considered to be fundamentals this study) that contribute focusing on the feeling of comfort, such as personal experiences, affective memory, the socio/cultural particularities, geographical aspects, materiality², among others.

There are authors who aim, in some way, to situate this notion of comfort by linking it to a series of factors that extrapolate the physical environment, as in the case of Aloisio Leoni Schmid (2005, p. 4):

I have reinforced the idea of comfort as something connected to the physical surroundings and the psychological context: past experiences, the imagination and dreams of relevance to environmental comfort, and if not understood, are capable of making the existence intolerable.

As quoted, the author extends even further by stating that a broader concept of comfort is “a fundamental valuable subsystem of architecture, comprising technical, practical and artistic values” SCHMID (2005, p. 5).

In fact, about comfort, will be adopted here some reflections of the author explored in “*The idea of comfort*” (2005). Similarly, the author questions the circumscription of the concept of environmental comfort boundaries imposed by the Physics and Physiology, that is, in order to put the discussion about comfort in a level to consider man as *environment*, and not as *observer of the environment*, it is necessary also to slant phenomenological approaches, about the experience of space. For Schmid (2005, p. 17):

If I decide to build my house at the street where I walk by every day, I know, in advance, where the Sun will rise in the summer, know its route in the spring, autumn, and winter. I already know what the noisiest side is; therefore, I remove the bedroom windows from there.

Schmid (2005, p. 4) continues, regarding the connection between the idea of comfort and the body sensations, and, above all, to point out a possible conjunction comfort/aesthetic pleasure, away from a purely mechanistic and parameterized vision of comfort.

A better look at the issue of comfort had been put, in some way, in 1960s, by Olgyay (1963, p. 11)³, when he describes a method of integration between what he considered fundamental to achieve an architecture dedicated to the comfort of the users. The author states in his study that four factors must be seen in harmony to an environmentally balanced result: *the climate variables* specified in given circumstances, understanding that each variable has a different impact; *biology*, insofar as the man is the fundamental reason for the construction of space and this is designed to fill all their needs; *the technology*, where we will find the answers to technical suitability of designed space; and,

²The idea of materiality used here does not refer simply to material specifications, but rather to the relationships that are established between users and materials in their specific applications and contexts.

³Victor Olgyay, 1910-1970, Hungarian Architect and Urban Planner, one of the precursors of bioclimatism.

finally, *the architectural expression*⁴ as the fourth participant of this set. Even without explicitly placing spatial relations and sensations in the experience of space, Olgyay (1963, p. 11) understands space and the user, as a complex, where all the factors and operative relations must function together, forming a single body.

THE PRAGMATIC COMFORT: NORMS AND QUALITY CERTIFICATION

Overall, the impacts from the development of life on Earth have been studied not long ago, the recent world meetings discussed the issues related to sustainability, and that, to some extent, align to new ideas about the environmental comfort. These ideas and concerns have emerged and become independent within the realm of architecture as the potential problems surrounding the planet's stability from the point of view of the environmental fundamental qualities to species survival, as the reduction of environmental and atmospheric pollution, the use of renewable natural resources and the disposal of scalar industrial production.

⁴ Architectural expression is understood as a design result obtained in consonance with the first three aspects pointed out by Olgyay.

⁵ MEADOWS, D.H., MEADOWS, P.L., RANDERS, J., BEHRENS III, W.W. *The Limits to Growth*, 1972.

The first objective movements, regarding the degradation of the environment and space built, dates back to decades of 1960/70, as the Meadows Report⁵, commissioned by the Club of Rome, fruit of the meeting of industrialized countries, proposing a greater control of industrial processes. The Meadows Report, published in 1972 - carried by a team of *Massachusetts Institute of Technology* (MIT) - headed by environmental scientist Donella H. "Dana" Meadows - opened discussions and dealt with big problems, already present at that time, as energy, pollution, sanitation, health, environment, technology and population growth, raising serious concerns in relation to natural and energy resources.

However, in 1968, Sweden proposes to the United Nations (UN) the opening of discussions on the environment, which culminates in June 1972, the first United Nations Conference on the Human Environment (considered as the starting point of the discussions about the environment), held in Stockholm that resulted, among other actions, the Declaration of Stockholm, and the proposed establishment of the United Nations Environment Programme (UNEP), aiming to promote and boost Sustainable Development, under the supervision of the Economic and Social Council, which sought to understand the close relationship between the environment and the socio-economic issues, even in industrialized countries.

The man is both work and the builder of environment surroundings, which gives them a living material and offers opportunity to develop intellectual, moral, social and spiritual. During the large and torturous evolution of the human race on this planet, a stage was reached in which, thanks to the rapid acceleration of science and technology, the man has acquired the power to transform, in countless ways and on an unprecedented scale, everything that surrounds them. The two aspects of the human environment, the natural and

*the artificial, are essential to the well-being and to the enjoyment of fundamental human rights, including the right to life itself.*⁶

In June 1992, Rio de Janeiro hosts the United Nations Conference on environment and development (UNCED), the ECO 92, where it was discussed the urgent nature of the problems and the interrelation between economic development and the protection of ecosystems planet. ECO 92, was signed by more than 170 countries in the Rio Declaration on environment and development. The focus was on sustainable development. Then come the Convention on Biological Diversity and the Framework Convention on Climate Change, in addition to the Declaration of Forests and Agenda 21.

⁶ Proclamation 1 extracted from the Declaration of the United Nations Conference on the Human Environment, Stockholm, 1972.

From the ECO 92, which is one of the most important landmarks in conferences on the Environment, international meetings and events dealing with environmental and climate conditions are being performed more frequently.

Some of the key events since the 1960s can be seen in Table 1.

From these meetings the operational guidelines laid down by conventions on climate are controlled and established, for control and development of the environment and atmosphere, with global targets to be achieved by the subscribers of the agreements of the conferences.

As fruits of these conferences and concerns about the environment, several countries involved in those discussions are setting their standards, qualifications and environmental control protocols.

Table 1: Main events since 1960.
Source: Authors.

• Foundation of the "Club of Rome", 1966.	• The Geneva Conference, 2002.
• Sweden proposes to the United Nations (UN) opening the discussions on the environment problem, 1968.	• World Summit on sustainable development known as the Johannesburg Summit, Earth Summit or Rio + 10, Johannesburg, 2002.
• Meadows Report (commissioned by the "Club of Rome"), 1972.	• COP 09. Milan Conference, 2003.
• Stockholm Conference (proposed by Sweden in 1968), 1972.	• COP 10. The Buenos Aires Conference, 2004.
• Toronto Conference, 1988.	• 2005. The Kyoto Protocol enters into force. The Framework Convention on Climate Change.
• The Geneva Conference, 1988.	• COP 11. The Montreal Conference, 2005.
• ECO 92 (UNCED), 1992.	• COP 12. Nairobi Conference, 2006.
• Letter of Aalborg, Denmark, 1994.	• COP 13. The Bali Conference, 2007.
• COP 01. The Berlin Conference, 1995.	• COP 14. Poznan Conference, 2008.
• COP 02. The Geneva Conference, 1996.	• COP 15. Copenhagen Conference, 2009.
• Letter from Lisbon (2nd European Conference of sustainable cities and Peoples), 1996.	• COP 16. Cancun Conference, 2010.
• COP 03. The Kyoto Conference, 1997.	• COP 17. Durban 2011 Conference.
• Rio + 5 Conference held in New York in 1997.	• COP 18. Doha Conference 2012
• COP 04. The Buenos Aires Conference, 1998.	• Rio + 20 Conference in Brazil, 2012.
• COP 05. Bonn Conference, 1999.	• COP 19. The Warsaw Conference, 2013.
• COP 06 (1). The Hague Conference, 2000.	• COP 20. Lima Conference, 2014.
• Conference in Hannover, 2000.	• COP 21. Paris Conference, 2015.
• COP 06 (2). Bonn Conference, 2001.	• COP 22. Marrakesh Conference, 2016.
• COP 07. Marrakesh Conference, 2001.	• COP 23. To be held in Bonn at the end of 2017.
• COP 08. New Delhi Conference, 2002.	

Figure 2: Presentation texts of NBR's.
Source: Authors.

<p>BNT NBR 9050 (1983/2015). Accessibility to buildings, mixture, urban equipment and spaces. Originally created in 1983, the NBR 9050 establishes criteria and technical parameters to be observed with regard to the design, construction, installation and adjustment of urban and rural, and building accessibility conditions. During the institution of these criteria and technical parameters, were considered various conditions of mobility and perception of the environment, with or without the help of specific devices, such as prostheses, apparatuses, wheelchairs, canes of tracing assistive listening systems or any other that will complement individual needs. In its last review it extended approach to people with permanent or temporary mobility within the idea of universal design.</p> <p>BNT NBR 10152 (1987). Noise levels for acoustic comfort. The NBR 10152 fixed noise levels compatible with the acoustic comfort in diverse environments by setting a weighted sound pressure level, sound pressure level, a-weighted sound pressure level and noise-Rating curve.</p> <p>BNT NBR 10151 (2000) Acoustics-noise assessment in populated areas, seeking the comfort of community – Procedure. The NBR 10151 set the conditions required for assessing the acceptability of the noise in communities, regardless of the existence of complaints; specifies a method for the measurement of noise, the application of corrections measured levels if the noise characteristics and a comparison of fixed levels with a criterion that takes into account several factors; proposed method of evaluation involves the measurement of the sound pressure level equivalent (LAeq) in decibels weighted on the "A", commonly called DB(A), with some exceptions.</p> <p>BNT NBR 15220 (2003). Thermal Performance of Buildings</p>	<p>The NBR 15220, under the general title "Thermal Performance of Buildings", is expected to contain the following parts:</p> <p>Part 1: definitions, symbols and units;</p> <p>Part 2: methods of calculation of thermal transmittance, thermal capacity, thermal delay and solar factor elements and components of buildings; Part 3: bioclimatic zoning and construction guidelines for detached houses of social interest;</p> <p>Part 4: measurement of thermal resistance and thermal conductivity by the principle of protected hot plate;</p> <p>Part 5: measurement of thermal resistance and thermal conductivity by the fluximetric method.</p> <p>This part of the NBR contains annex A, as a matter of record only.</p> <p>This aims to establish definitions and the corresponding symbols and terms related to the thermal performance of buildings.</p> <p>ABNT NBR 16401-1, 2 and 3 (2008). Air conditioning installations: designs and comfort parameters.</p> <p>The NBR 16401, under the general title "air conditioning: Central Unit and Systems" is expected to contain the following parts:</p> <p>Part 1: project of installations;</p> <p>Part 2: thermal comfort parameters;</p> <p>Part 3: indoor air quality.</p> <p>ABNT NBR that CIE 8995 (2013). Lighting of Work Environments.</p> <p>The NBR 8995, under the general title "Lighting of Work Environments", specifies:</p> <p>The lighting requirements for internal workplaces and the requirements for people to perform visual tasks efficiently, with comfort and safety during the entire period of work.</p> <p>This standard does not specify how the lighting techniques or systems must be designed in order to improve the solutions to specific places of work. These can be found in the relevant guides and reports of CIE.</p>
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PARAMETERS/STANDARDS	NBR 9050	NBR 8995	NBR 10151	NBR 10152	NBR 15220	NBR 16401
Sizing	X					X
Accessibility	X					
Weighted sound pressure				X		
Pressure level			X	X		
Noise Rating curve				X		
Evaluation of the acceptability of noise			X			
Symbols and thermal units					X	
Thermal Transmittance					X	
Brazilian bioclimatic zoning					X	
Constructive guidelines for dwellings					X	
Thermal resistance					X	
Installation projects of air-condition						X
Thermal comfort parameters						X
Indoor air quality						X
Luminance distribution		X				
Illuminance		X				
Blurring		X				
Directionality of light		X				
Aspects of the color of light and surfaces		X				
Flicker		X				
Natural Light		X				
Equipment maintenance		X				X
Aspects of the sensory apparatus of the human body and their experience/experience with the space/medium that surrounds						

Table 2: Comparative table between the parameters used in Brazilian standards.
Source: Authors.

Among the various certifications and existing standards, it must be mentioned here those that, not only for its high qualification, but also, above all, for its specific targeting on the built environment and space for its relevance with the purposes of this work. Which are:

A.) The Brazilian Standards (NBR) edited by the Brazilian Association of Technical Standards (ABNT), strive to establish parameters for the application and control for various fields, and, in the cases studied here, are, as can be seen by its dates, some are quite new by national point of view. The presentation texts of NBR's in Figure 2 have been extracted from their original documents.

Table 2 indicates a summary of parameters analyzed and/or applied in NBR's listed in Figure 2.

B.) The Environmental Quality Certifications, are certificates of concepts and measures adopted to ensure good principles for use in areas where they apply. In the case of this

Figure 3: Environmental Quality Certifications.
Source: Authors.

<p>High Environmental Quality (AQUA). Environmental quality of new constructions or renovations. AQUA certification, based on the homonymous French methodology HQE, is a process of project Management for high environmental quality in new ventures. That quality is demonstrated to customers, investors and other parties through the certification. The certification was adapted to Brazilian reality from the French HQE certification system (Haute Qualité Environnementale). The benefits of AQUA certification for entrepreneurs are: Demonstrate the high environmental quality of the project Highlight your property on the market Increase the speed of sales or lease Associate the image of the company towards sustainability Improve relationships with environmental agencies and communities. The advantages to buyers are: Water and energy saved during the life of the property; Reducing the cost of condo; Best comfort and health conditions; Patrimony appreciation over time; Lower costs of operation and maintenance.</p> <p>Blue House Certificate. Socio-environmental Classification of the Caixa Econômica Federal, Brazil. The Blue House certification, issued by the Caixa Econômica Federal, is an instrument of socio-environmental classification of housing developments projects and aims to:</p> <ul style="list-style-type: none"> • Encourage the rational use of natural resources in the construction and operation of housing developments • Reduce the cost of maintenance of the buildings and the monthly expenses of its users • promote awareness of entrepreneurs and residents about the benefits of sustainable buildings • Publicly recognize the entrepreneurs who adopt more sustainable practices in designs and construction of residential complexes • Provide guidance on sustainable constructions for proponents of housing projects. <p>LEED. Leadership in Energy and Environmental Design, whose certification is carried out by the Green Building Council (GBC).</p>	<p>This certification works for all buildings and can be applied at any time in the venture. The projects seeking LEED certification will be analyzed by 8 dimensions. All have prerequisites (required practices) and credits (recommendations) that the measure met, guarantee points to the building. The certification level is defined as the amount of points earned, and may vary from 40 points to 110 points. The certified levels are Silver, Gold and Platinum. Account the following benefits: Economic Reduction of operational costs Reduction of regulatory risks Valuation of property for sale or lease Increase in speed of occupation Increased retention Modernization and lower obsolescence of the building Social Improves security and prioritization of the health of workers and occupants Social inclusion and increase the sense of community Professional training Awareness of employees and users Increased employee productivity; improvement in the recovery of patients (in hospitals); improved performance of students (in schools); increase in the momentum of buying consumers (in businesses). Encourage suppliers with greater social and environmental responsibilities Increased satisfaction and well-being of users Public policy stimulus to promote sustainable construction Environmental Rational use and reduction of extraction of natural resources Reduction of water and energy consumption Conscious and orderly deployment Mitigating the effects of climate change Use of materials and technologies for low environmental impact Reduction, treatment and reuse of the waste from construction and operation.</p> <p>LEED for Homes. Is in fact the transposition of LEED-GBC concepts specifically for single-family residential buildings adopting appropriate principles from the point of view of the building as well as the impacts on the environment.</p>
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study, related to the built space, we named a few below for better understanding its principles (Figure 3).

Tables 3 and 4 are summaries of statements parameters applied and/or examined by the certifications listed in Figure 3.

We can check that as demonstrated in tables 2, 3 and 4, user actions/relations acting on the building or the environment are not considered. Although, in some cases, the tables mention the possibility of acquiring knowledge about environmental issues, these acquisitions are brought a priori by the norms / seals, diffused and shared with the inhabitants of the spaces, thus limiting their wide and diversified experience with the place.

In a complementary vision that advocate the norms and environmental certifications, Lima (1997, p. 201-220) alerts in his article that the issues involving the environment, seen by the environmental analysts over and above the standards and certifications, cannot fail to consider the living conditions of the populations, notably the poorest (socio-economic factors), closely related to the degradation of the environment, and proposes an approach of the natural and social sciences, in the construction of a new environmental awareness.

Table 3: Comparative table between the parameters used by the certifications. Source: Authors.

PARAMETERS/CERTIFICATION	AQUA	BLUE HOUSE	LEED	LEED FOR HOMES
High environmental quality of the project	X			
Differentiate your property on the market	X			
Increase the speed of sales or lease	X			
Associate the image of the company towards sustainability	X			
Improve relationships with environmental agencies and communities	X			
Water and energy saving during the life of the building	X			
Reducing the cost of condo	X			
The best conditions of comfort and health	X			
Patrimony appreciation over time	X			
Lower costs of operation and maintenance	X			
Encourage the rational use of natural resources in the construction and operation of housing developments		X		
Reduce the cost of maintenance of the buildings and the monthly expenses of its users		X		
Promote awareness of entrepreneurs and residents about the benefits of sustainable buildings		X		
Recognize publicly the entrepreneurs who adopt more sustainable practices in designs and constructs residential complexes		X		
Offer guidance on more sustainable buildings for proponents of housing projects.		X		
Reduction of operational costs			X	X
Reduction of regulatory risks			X	X
Valuation of property for sale or lease			X	X
Increase in speed of occupation			X	X
Increased retention			X	X
Modernization and lower obsolescence of the building			X	X
Improves security and prioritization of the health of workers and occupants			X	X
Aspects of the sensory apparatus of the human body and its experience with the space/environment that surrounds them				

Table 4: Comparative table between the parameters used by the certifications. Source: Authors.

PARAMETERS/SEALS	AQUA	BLUE HOUSE	LEED	LEED FOR HOMES
Social inclusion and increase the sense of community			X	
Professional training			X	
Awareness of employees and users			X	X
Increased employee productivity; improvement in the recovery of patients (in hospitals); improved performance of students (in schools); increase in the momentum of buying consumers (in businesses).			X	
Encourage suppliers with greater social and environmental responsibilities			X	X
Increased satisfaction and well-being of users			X	X
Public policy stimulus to promote sustainable construction			X	X
Rational use and reduction of extraction of natural resources			X	X
Reduction of water and energy consumption			X	X
Conscious and orderly deployment			X	X
Mitigating the effects of climate change			X	X
Use of materials and technologies for low environmental impact			X	X
Reduction, treatment and reuse of the waste from construction and operation.			X	X
Aspects of the sensory apparatus of the human body and its experience with the space/environment that surrounds them				

Yi-Fu Tuan, geographer, China, 1930. It is of his own one of the most important books dealing (from a vision of humanistic geography) affections related to built environments or even natural: *Topophilia: a study of perception, attitudes and environmental values* of 1974.

THE POETIC COMFORT: AMBIENCE AND SUBJECTIVITY

When you seek other possibilities to understand the idea of comfort, and even the perception of space, the way of being affected by the place can be problematized and integrated with the tacit use of known senses that our body has, by understanding how these senses interact with each other and react to the stimuli we receive not only from the external environment but also from our inner environment, our temperature, smell, hearing, vision, our organs, our affective memories.

Even great architects as Campo Baeza, Norberg-Schulz, Peter Zumthor, and professionals of other areas such as the award-winning geographer Yi-Fu Tuan⁷, or philosophers as Gaston Bachelard, or the mixture of sculptor/architect/physicist Kent Bloomer, think that the idea of comfort is under a more holistic perspective, aware that the space is a producer of sensations and emotions, and that, in this sense, puts the human being not as a passive entity outside the space, but rather active, as the place enhances its use and sense of well-being.

In Norberg-Schulz (1979, p. 195) there is a statement about the connection between the person with the architectural space through its components, in which, looking at the different possibilities of relationships and moments of the observer, the author states the plurality of events, interacting with the architectural space that, in his view, is endowed with multiple private contact points. It is exactly this set of contact points (which differs from person to person), that confirms to what we can describe as a *surrounding reception*, of well-being, that is, these are relational conditions between the users and the place that allow them to feel comfortable, not only from applicable indices such as temperature, luminous, sounding, etc.

Under a holistic perspective, the senses work *in body*, integrated with each other and the environment. In addition, they coexist in an extended way although sometimes we do not notice.

This holistic approach, questioning a limited understanding of the senses, will allow us to expand the understanding of the environment in a way similar to augmented reality. According to Bloomer & Moore (1977, p. 34) the senses are not imprisoned in the *Tools* that use them. The sense of touch, for example, is not restricted to the surface of the hands, but widens to the whole body through the skin; what allows us to infer that the eye can *perceive* much further than a simple stamped image on the retina. According to Bloomer & Moore (1977, p. ix):

We believe that, before we can understand how buildings affect individuals and communities emotionally, as they broadcast people's feelings of joy, identity and place, there is no way to distinguish the architecture from any act daily life of construction.

The sense of touch, understood as a mechanical way of hands to find an object or a surface that is, takes us to an extreme reductionism of the power of this sense. Still in Bloomer & Moore (1977, p.34) on haptic systems, the authors affirm that they imply in perceiving the environment incorporating sensations

such as pressure, heat, cold, pain included in the sensorial detection spectrum, which involves physical contact outside and within our bodies.

To understand comfort as a set of sensations, far beyond the measurements, the geographer Yi-Fu Tuan states his condition of life and experience. This experience of feeling alive offered by the space, somehow appears traditionally in great architects. According to Tuan (1995, p. 102):

The architectural space - even a cabin surrounded by land - can set these perceptions and make them alive. Another influence is: the built environment involves or even requires social roles and relationships.

Tuan (1995, p. 8) points out that the experience is the main way for the various paths through which people understand and build their reality. These modes of perception from the more direct and passive, as the basic senses (smell, taste, touch, etc.), to the most sophisticated and oriented forms of our visual perception, affective memory, and the way we rationally and spiritually create the symbolism. The human body is a living body, a complex of feelings and emotions that builds its humanized space, which therefore are spaces that respond to their deepest longings, and thus the understand the power of their senses.

The architect Alberto Campo Baeza, who on several occasions talked about the human connection with the architectural space, says that one of the most important aspects is the light (Figure 4), giving interesting qualities of materiality and temporality: *“the light build time, the light is the material capable of connection the man to architecture”* (BAEZA, 2009, p. 33).

It also extends from the unspeakable states of mind that haunt us as we experience the architectural space, the sensitive citation of Baeza below when referring to Barragán⁸, where one can perceive that we cannot escape the wider, haptic, to relate to the architectural space.

Barragán proclaimed in his speech on receiving the Pritzker Prize that “the words beauty, inspiration, witchcraft, enchantment, “and also” serenity, silence, intimacy and awe “had disappeared from publications dedicated to

⁸Luis Ramiro Barragán Morfín, México (1902–1988), Pritzker Prize in 1980.



Figure 4: Temple of Zeus (Detail). Athens, Greece. Source: Photo by the authors.

Figure 5: Luis Barragán's Studio House patio, Colonia Daniel Garza, Mexico City. Source: Wiki Commons <https://commons.wikimedia.org/wiki/File:Overhanging_plants_on_roof_of_Luis_Barrag%C3%A1n_House,_Mexico_City.jpg>



⁹Steen Eiler Rasmussen, 1898 – 1990, Danish Architect and Urban Planner.

architecture. And the master was right. Someone may seem that all these terms belong to a diffuse, ethereal or unattainable world, reserved only a few Druids of architecture (BARRAGÁN, 1980).

The courtyard (Figure 5), where time seems to park waiting for us, with its vegetation lazily descending the walls in its vibrant colors, covered by a sky of rare blue in Barragán's residence, attest very well the words of Baeza about the master.

Barragán retains, as categories of analysis, words that seem to have come out of our vocabulary and entered into a *secret manual* such as beauty, inspiration, *witchcraft sorcery*, enchantment, serenity, silence, intimacy, amazement, etc.

Rasmussen⁹ (1998, p. 233) when speaking of sound in architecture, build a beautiful set of images generated by the sounds on architecture. Not saying that the buildings naturally produce sounds, but that has its own sound to reverberate actions like our steps, the wind, running water or in an orchestra that when it plays, reverb spaces and floods our audio/affective memory.

Apparently, some architects mentioned above line up to thoughts of Bloomer & Moore, but this alignment also occurs in other areas such as the geographer Yi-Fu Tuan, quoted earlier in this study, what makes us think these ideas are not unusual to other fields of knowledge.

Bachelard pointed out in the last century, a strong relationship between sound and memory. Bachelard affirmed (no/date, p. 58):

For those who know how to listen to the house of the past, would not it be a geometry of echoes? The voices of the past resonates differently in a large room and a small bedroom. Otherwise, still resonate the calls on the stairs. Regarding difficult memories, well beyond the drawing geometries, you must rediscover the hue of light, then the sweet scents that are in empty rooms, putting a stamp on each one of the rooms of the house of memories. It will be possible, in the afterlife, restore not simply the stamp of voices, "the inflection of the beloved voices that were silent", but still the resonance of all the rooms of the sound house?

THE CONSTRUCTION OF THE IDEA OF COMFORT IN PETER ZUMTHOR

For better understanding, this study will deepen in the mind of the architect Peter Zumthor, who reveals a series of categories for the formulation of the idea of comfort in the architectural environment.

In order to reference it:

In June 2003, Zumthor participates in the Festival of music and Literature of Germany in Ostwestfalen-Lippe. In the Renaissance palace of Wendlinghausen, where he lectured, the architect discusses among other categories, the understanding of beauty, as issues of our experiences in architectural space and relates to the idea of wellness, of comfort, as an example with the own environment of the Palace. This series of approaches, compiled, led to the publication of one of his most acclaimed books titled *Atmospheres* originally published in 2006 in Basel, Switzerland. "*The title has its origins in my interest for a long time, of course, about: what is the architectural quality?*" (ZUMTHOR, 2006, p. 11).

A sensitive look of his ideas, expanding the idea of comfort, Zumthor offers us his concept of *atmospheres*, a corporeal response of environments to our sensations, attributing those (atmospheres) some of the categories of aesthetics. At this point we can infer that, far beyond static conceptions and automatism, the architectural experience, according to Zumthor, approaches the art, when we understand it as able to meet people not only within the restricted uses aspects of the spaces, but also the emotional and spiritual pleasures of them when you say that "*architectural quality can only mean that I'm touched by a work*" (ZUMTHOR, 2006, p. 11). Other sensations addressed by Zumthor in his lecture, understood here as categories, refer to that "*it touches us immediately*", and assigns the work of the architect "*one hand craftsmanship in this task of creating architectural atmospheres*" (ZUMTHOR, 2006, p. 21).

Zumthor proposes nine answers (here understood as categories) of how to build atmospheres:

1. The body of architecture - "*[...] material presence of architecture objects, of the building*" (ZUMTHOR, 2006, p. 23);
2. The harmony of materials - "*[...] they sound together and radiate*" (ZUMTHOR, 2006, p. 25);
3. The sound of space - "*Listen up! Each space acts as a great instrument, collect, increase and transmits the sounds*" (ZUMTHOR, 2006, p. 29);

It is worth stressing, in consonance with Zumthor, an interesting passage from the architect Rasmussen, where he questions about the loudness of the architecture.

Could architecture be heard? Most people would probably say that, as the architecture does not produce sounds it could not be heard. [...]. Rarely realize how much we can hear it. We received a total printing of the thing for which

we are looking and we do not pay attention to the many ways that contributed to that impression (RASMUSSEN, 1998, p. 233).

4. The temperature of the room - *"I believe that every building has a certain temperature"* (ZUMTHOR, 2006, p. 33);
5. Things around me - *"It happens whenever I walk into buildings, friends' rooms, acquaintances or people I don't know, being impressed by the things they have in space to inhabit or work"* (ZUMTHOR, 2006, p. 35);
6. Between serenity and seduction - *"[...] relates to the fact we are moving within the architecture"* (ZUMTHOR, 2006, p. 43);
7. The tension between the interior and exterior - *"Unfolds the game between the individual and the public, between privacy and the public. That's what the architecture works"* (ZUMTHOR, 2006, p. 47);
8. Steps of intimacy - *"Relates to proximity and distance. [...] I'm talking about a physical sense of scale and dimension"* (ZUMTHOR, 2006, p. 51);
9. The light on things - *"[...] think the building initially as a mass of shadows and then, as in the process of excavation, put lights and let luminosity penetrate"* (ZUMTHOR, 2006, p. 61).

In addition, the characteristics of the spaces, in the atmospheres of Zumthor, the way materials, sounds, colors, finishes or even its size and history are applied, we will have different results, and certainly, we need all haptic amplitude in our bodies to perceive them. *"[...] I hear the heavy entrance door fall on the latch [...]"* (Zumthor, 2005, p. 9).

His extreme ability to conceive spaces, where the expression of materiality extends beyond the limits of physical confrontations, entering deeply in the most intimate emotions of those who inhabit it, refers to the more particular of our memories and souvenirs.

Zumthor also explores in *Atmospheres* what he called *"supplements, transcendences"*, they are:

1. Architecture as an immersive space

When I build, a large or a small complex, I like to imagine that this becomes part of the surrounding space. [...] Moreover, this surrounding space becomes part of my life, or, in most cases, of people's lives. [...]. Makes me happy to imagine that someone perhaps remembers this building in 25, 30 years. Maybe because there they kissed their first love. The reason does not matter. It's just to explain that I like this idea more than to imagine that this building, 35 years from now, will still be included in some architectural dictionary (ZUMTHOR, 2006, p. 65 and 66).

2. Harmony

It is more of a feeling. [...] However, it is beautiful when things harmonize. Becomes a part of a whole. The place, the use and the form. The form refers to the place, this is the place and the use is this (ZUMTHOR, 2006, p. 69).

3. Beautiful shape

I might find it in icons; I recognize it sometimes in still life, which help me to see how something found its way, but also in the day-to-day tools, literature and musical parts (ZUMTHOR, 2006, p. 73).

Another aspect addressed in Zumthor refers to memory, as a category of analysis, where rather than measure decibels, it would be better to search a affective relation, humanized, with the noises produced and characteristic of each ambience as the sound of footsteps echoing walking around, “*the sounds of my mother while working in the kitchen or the noises of the city or a nearby train station*” (ZUMTHOR, 2006, p. 31).

In the essay *An intuition of things*, in 1988, which opens a compilation of various texts of Zumthor, published in *Thinking about the architecture* (2005), the author already identifies categories of comfort in relations with the environment, well beyond the most technical classifications applied, and, continuing, in the parameters and tables, but extending all the dimensions that always arise among things. Zumthor refers to contacts and images (that comes up when we roam around the environments), which relate directly with our senses of touch, smell, sight and others “*Remember the noise of the pebble under my feet*” (ZUMTHOR, 2005, p. 09), providing unique and singular experiences related to our lives and memories. According to the author, we communicate with spaces through the private relationships we have established with certain items or materials, which together will shape our affective and sensory memory. In Zumthor (2005, p. 31):

The reality that interests me and for which I want to focus my imagination, is not the reality of the detached theories of things, but the one that points to inhabit, the architectural concrete task. Is the reality of the materials – stone, fabric, steel, leather...– and the reality of the buildings that I use to build, the characteristics of which try to penetrate in my imagination, committed to finding sense and sensuality, so you can maybe turn on the spark of a successful work, able to give housing to men.

When describing his childhood memories, Zumthor refers to *dwelling*¹⁰ space, through its multiple experiences as the sound of the locks of the doors, the shape of the handles under your hands, the penumbra and smells, the softness and temperature of the asphalt under his feet. “*This kind of memories contain the deepest architectural experience that I know*” (ZUMTHOR, 2005, p. 09).

The idea of comfort of Zumthor, understood above all as an aesthetic category, is closely associated with the surrounding space; the idea, defined as having a harmonic *atmosphere* to form all elements that belong to that space as light, temperature, the power of the environmental sound and materials related to memory. In the words of Zumthor (2006, p. 11):

Architectural quality can only mean that I am touched by a work. But why the hell do these works touch me? And how can I design such a thing? [...]. How can I design stuff like this, which have a presence as beautiful and natural to touch me ever again. A designation for this is atmosphere.

¹⁰The Dwell to which Zumthor refers, is aligned with Heidegger’s broad idea of dwelling in his 1954 essay, “*Building, Living, Thinking*”, where he points out: “*The relation of man to places and through places to which spaces are based on dwelling*”, the broad sense of life and thought in places and spaces, in an enlarged form capable of harboring both body and spirit.



Figure 6: Baths of Vals, Switzerland.
Source: Wiki Commons. <https://upload.wikimedia.org/wikipedia/commons/c/cd/Therme_Vals_indoor_pool%2C_Vals%2C_Graub%C3%BCnden%2C_Switzerland_-_20071026.jpg>



Figure 7: Chapel of San Benedicto, Switzerland.
Source: Wiki Commons <https://upload.wikimedia.org/wikipedia/commons/8/8e/Saint_Benedict_Chapel_3.jpg>

When analyzing his works, one can verify in the spaces produced by Zumthor all the power with which he carries them.

Let us take two examples: first, the famous Baths of Vals (1996), in Switzerland, it is understood the way the architect performs his atmosphere (Figure 6), from three ideas/elements, as the fluid/water, the diaphanous/light and solid/quartzite. Zumthor can extract the simplicity of each of the *materials* employed (yes, water and light are also for P.Z) all the power able to create atmospheres with various nuances in the spaces of the baths, whether with the light, or with the *temperature* of the waters and the spaces, sometimes with the relations of scale, extraversion and intimacy, dimensioning the spaces molded by the stacking of the stone used, very common in this region of the Swiss Grisons.

A second example (Figure 7), in the chapel of San Benedicto (1988), in Sumvitg, a small village in Switzerland (with a population that barely reaches 1500 inhabitants), Zumthor, from light and wood, catalyzes the whole history, culture, affection and experience in a local simple ellipse at the top of a hill where one of the focal points (of the regular two-stroke the ellipse's points) moves to the perfect geometry perimeter and tension, gently extracting hence the area of access to the small temple. The light, similar to a godsend, permeates throughout the upper perimeter of the whole construction in wood, flooding the interior with a gentle, but firm, enlightened aura.

These are dimensions that go far beyond the measurement of lumens, Celsius degrees, or decibels; it goes directly to our emotional memories, to our experiences. What do we care about when we are next to a waterfall? More than 85 decibels of sound of water falling *noisily* between the stones or the sensations that we share with the supreme ambience of nature of a waterfall? (Figure 8).

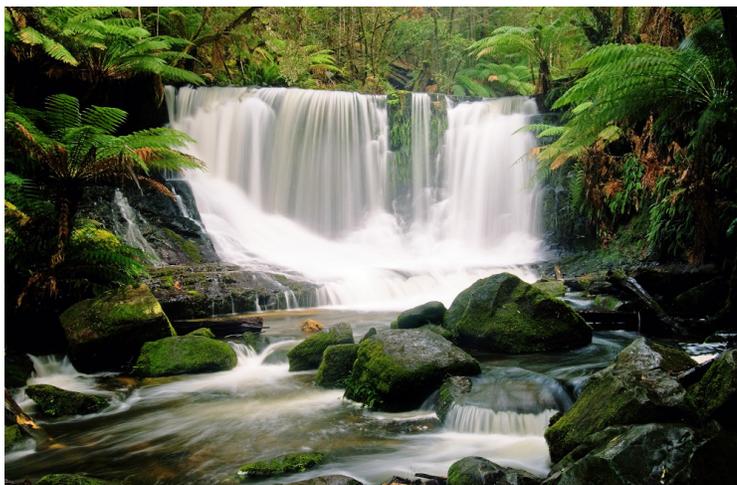


Figure 8: Horseshoe Falls (Tasmania).
Source: Wiki Commons <https://commons.wikimedia.org/wiki/Waterfall#/media/File:Horseshoe_falls_fw.jpg>



Figure 9: San Vidal, Venice, 17th century.
Source: Photo by the authors.

And if something brings sense of peace, meditation, comfort, *warmth*, to hear the Four Seasons by Vivaldi on a cold night in the interior of the Church of San Vidal (Figure 9), from the XVII century in Venice, in won't be so only because of their squares meters, but for all the consonance that this magnificent space conveys to us, added to its history, conformation, materiality and time delicately deposited on its walls. A *place* connected not only with the resonance of sound, their reflections and absorptions, but also in a constant dialectic with all a spatial arrangement that causes the body to merge with available space, a service or even a musical work.

It is exactly in this complex of sensations transmitted by spatial experience that we try to understand the various expressions of how the idea of comfort can reveal itself in a field that doesn't speak of measurements, of transcendent parameters, the *ideal comfort*, but relates to laterality, *immanence*, affection and memory.

CATEGORIES/SENSES	TOUCH	HEARIN	MEMORY	SIGHT	SMELL	DIMENSION	EMOTION
The architectural body	X	X	X	X	X	X	X
The consonance of materials	X	X		X			X
The sound of space		X	X			X	X
The temperature of the room	X		X	X		X	X
The things that surround me	X	X		X	X		X
Serenity and seduction	X	X	X	X	X	X	X
The tension between the interior and exterior		X		X		X	X
Steps of intimacy		X	X	X		X	X
The light on things			X	X		X	X
The surrounding space architecture	X	X	X	X	X	X	X
Harmony	X		X	X		X	X
Beautiful shape		X	X			X	X
Aspects of technical relations in space around us	X	X		X		X	X

Table 5 presents a summary statement of relations addressed by Zumthor. It is noteworthy that here the name of the column, existing in previous frames, has been replaced by **CATEGORIES**, and the name of the lines **STANDARDS** and **CERTIFICATION** the line called **SENSES**:

Table 5: Summary of the relationship categories with the body/space in Peter Zumthor.
Source: Authors.

It is interesting to note that in this summary of Table 5, one can realize that besides the original categories in Zumthor, most technical aspects still have relations between man/space, which in fact are not invalidated even within a more subjective perspective.

CONCLUSION

Looking at the contemporary world, we realize there is a tendency to collect and analyze the facts so airtight, isolated. The correlations between them are, as a rule, demonstrated or even replaced by graphics, independent data, that although illustrate the events itself, it does not add much than simple numerical compilations that has a strictly technical and standardized trend of the fields of knowledge.

Technical standards and widely used certifications, by its very nature, does not propose to explore aesthetic experience, and, in general, are more widespread application, therefore, have the purpose of regulating various parameters, even in differentiated conditions. Most of these standards are applied, for example, at buildings in different climatic situations (where they expect to find different environmental conditions), and indicate to the uses, similar parameters (comfort zones)¹¹ based on tables studied for those purposes.

A sense of well-being, and comfort will certainly open a parenthesis in the measurements techniques (and they must collaborate effectively), numeric parameters that define quantitatively and not qualitatively the spatial conditions that we are being submitted in a given place. These are not negligible, but, on the contrary, would be important as of it took into consideration factors of aesthetic experience of space as those already mentioned above.

Dianna Santiago Vilela reinforces in her dissertation, that, when it comes to the environment, you can't divide the constraints that act on the construction due to leakage and view it separately. The climate, cultural traditions, use of natural resources, the problem of waste, are all connected to the welfare of men: "*should always be essential in design and in the development of architectural design and urban planning*" (VILELA, 2007, p. 67).

At a time when various environmental issues and basic principles for our survival and the planet are on the spotlight and being discussed, it seems of great importance to understand and extend these discussions to closer spatial relations, more sensitive to the beings that inhabit it - and placing them as protagonists - such as those found in the body/sensory levels of interaction with the space constructed as a producer of a more affective/sensitive body and not so rough.

These spatial interactions, which in most situations are overlooked, influence our behavior in a dramatic and intense way, and through a systematic reading, we can assess their impacts and translate them into guidelines that can collaborate in a better user matching.

¹¹ Check Corbella;Yannas, (2003), p. 30.

Given these different views, especially the most critical, it is believed that, in addition to a reading of, so to speak, physical measurements (temperature, wind speed, relative humidity, etc.), there might be other *evidences* that contribute to qualifying conditions for the comfort of the internal or external environments. It is also understood that these conditions are also influenced by how different individuals relate to the environment in which they find themselves, extending the idea of comfort to particular and affective relationships, to the extended sensory experience of space, without thereby dissociating it from environmental issue.

Even though the categories and certification standards exists, you can't look at the environmental comfort problem simply as a compliance of the norms, but rather how at least as a sustainable comfort looking under two inseparable prisms: one that touches us immediately, that is the experience, aesthetics, architecture, experience of space; and another that makes us meet, the external issues, which deals with the ethical-political experience which discusses in depth the sustainability of the planet.

On the other hand, it is fundamental to broadly understand the environment, not only with attention to climatic cyclical phenomena and their evolution, but considering it in a complex way also involving regional, social and economic issues, that is, the human being, his body, his productive and social activities that are inextricably linked to the environment. It is understood, therefore, that the notion of comfort should not be restricted only to questions of parametrized and predetermined controls of diverse physical indices.

The idea of comfort, in view of the professionals mentioned above, beyond the narrow limits, say, between walls, should be extended to a wider relationship that naturally involves not only individual well-being, but also the collective.

If within a limit built we can talk about the relationships that we convey a feeling of comfort, on the other hand, the urban space, puts us broader issues ranging from the simple pleasure of walking on the sidewalks to interactions with the collective, with public services and, above all, with local weather conditions, largely sharpened by the urban space (DÍSCOLI, et al, 2016, p. 38-39).

When you search other categories in order to understand the relations between comfort/human/space, one can understand that it is necessary to separate the observations in two fields: the space constructed to dwell where relations are private, closer, narrower, and the more impersonal, public space, where relationships include not only the places themselves, but above all embody the social and economic, understanding the public welfare as well as the comfort attribute.

Could we then infer that the concept of comfort extends way beyond norms, and differs by being directly linked to the sensory experience of who inhabits the space?

Could we think of actions and particular conditions that we play in the architectural space, and, above all, the preservation of the planet, since the idea of comfort does not necessarily come to mind when you think of increasing energy consumption and non-renewable commodities?

Here are the issues which certainly still has a long road to be traveled.

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