Mobile Sustainable Shelter for Urban Nomads
Development of the Preliminary Study

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Abstract

The number of citizens who, by choice or forced by economic or social conditions, are living in big cities without a permanent home is increasing. The large cities have a shortage of solutions that support an urbanistically nomadic lifestyle, which results in unwanted appropriation of public spaces and consequent degradation of the urban landscape. In response to the mentioned issue, it is presented a preliminary study for the development of a mobile shelter intended for any type of urban nomad that responds to their most basic needs, included on the theme of sustainability.

The assumptions that define the requirements of the proposed shelter are supported by an investigation moment that begins with the search for project examples whose purpose is similar to the present work. Sustainable principles that embrace the design ideas are justified through a research of sustainable development theme. The foundation of the requirements ends with the understanding of the life dynamic and daily needs of an urban nomad, based on the situation of homelessness by presenting themselves as the most precarious example of this situation.

The proposed model has characteristics that allows easy mobility coupled to the versatility of functions, according to the momentary needs of the user. The sustainable shelter is characterized by easy transport, presenting itself as an unitary piece, foldable and lightweight, made of materials that fit the theme of sustainability and contribute to the physical well-being in the occupation of interior space at any time of the year.

As standing before a preliminary study, each proposed solution represents an hypothesis to response to the specific mentioned problem at any stage of the design process, being always subject to future changes.

KEYWORDS: Shelter; Sustainability; Urban Nomadism; Comfort; Mobility.
Introduction

The main purpose of this dissertation is the development of the preliminary study for a mobile shelter intended for any type of urban nomad and responsive to their most basic needs.

On the basis of the dissertation theme is the issue of sustainability and, therein, is intended to achieve a model with features which will allow an easy mobility combined with the versatility of the piece, according to the momentary needs of the user. In this regard, the shelter must be characterized by easy transport, light, unitary disassembly and made of materials which are related to the theme of sustainability and contribute to physical well-being in the occupation of interior space at any time of year.

To develop a final model embracing all the proposed features it is essential to understand what are the assumptions, sustainable and according to the target audience, that define the requirements of the shelter and shape the proposal.

In the first phase of the thesis a set of searches are conducted that, complementing each other, allow to launch ideas and assumptions to structure the shelter. Three areas of research are intended (i) to look for practical examples of shelters with points of interest that can contribute to the development of the proposal, (ii) the study of sustainability theme and (iii) research on the urban nomadism’s world.

1. The Shelter – State of Art

1.1. Historical Context of the Shelter

The shelter, primary element of protection, arises from the need to defend men against the nature dangers: wild animals, weather conditions or other elements. The constant search for shelter and architectural adaptation over the times makes the evolution of man inseparable from the evolution of architecture. The first known shelter of mankind is the cave, a space naturally created by the earth's negative that offers the condition of protection against the external elements.

As human needs were growing and changing it became necessary to improve the buildings which served as shelter, varying according to time and place (Anders, 2007). This need origined the firsts architectural manifestos of primitive man, through small buildings known as dolmens, Tholoi, artificial caves or menhirs (Pinto, 2007).

Nomadism was one of the main feature of first men, who by factors such as climate changes or food shortages were forced to look for new lands propitious to their survival. To support this new lifestyle the first transportable buildings began to emerge, as exemplified by the Tipi tents of north american indians or the Yurt in Asia (Anders, 2007).

The World Wars also gave rise to new techniques for mobile buildings, as exemplified by the Nissen Hut, designed for military purposes (Taylor, 2009).
1.2. Shelters for Hostile Environments
The constant territorial, water and space exploration also involves a prolonged human stay in inhospitable environments where resources are scarce or non-existent, but where the basic needs prevail. To allow the presence of man in places like Antarctica, the Sahara desert, the bottom of the sea or the Moon, it was necessary to develop management systems and self-sufficiency of resources that allow to spend extended time in a harsh environment.

As the main types of shelter used in hostile environments are presented the examples of spatial shelter, submarine and shelters to explore the continent of Antarctica. These examples are interesting because of the way that the space is saved and the constructive adaptation depending on the perceived harsh environment.

1.3. Sustainable Shelters
Sustainability is a term referring to any attempt involving a balanced and cost-effective use of necessary resources for carrying out an activity (Mestre, 2012), reaching various sectors of society and contributing to environmental, social and economic development suited to the needs of the current world (Pinheiro, 2006).

According to the sustainable theme, there are presented three examples of buildings that focus their sustainability in the optimization and flexibility of space and available resources to give shelter. From the presented examples stands out with the main relevance for the preliminary study development the Paper Log House from japanese architect Shigeru Ban, which uses paper tubes as a structural element in their buildings. This material will also be used in the proposal for the previous study (see Chapter 5).

Figure 1.1 | Shelters in response to victims of natural disasters in India, Shigeru Ban.

1.4. Individual Transportable Shelters
Before an urbanistically nomadic lifestyle, there are already numerous theoretical and practical professionals that study the possibility of creating a portable shelter, strong enough to protect users from the outside elements and with the ability to preserve the dignity from who, as a necessity, constantly looks for cover (Lepisto, 2009).

Among the many presented examples that can help understanding what may be the proposed shelter, stand out the projects Tricycle House from PAO+PIDO (Furuto, 2012) and Instant Housing from Winfried Baumann (Brownstone, 2014), by their ability to use the shelters keeping the transport character.

Figure 1.2 | Tricycle House from PAO+PIDO.

Figure 1.3 | Instant Housing from Baumann.
2. Sustainability - A Common Duty

2.1. Sustainable Development
In this section is contextualized the emergence and evolution of the concept of sustainable development. For the historical background are presented some conferences and publications that contributed to the concept now applied. The most striking definition is presented through the publication of the Brundtland Report (1987), also known as "Our Common Future", defined as the "development that responds to the needs of the present without compromising the ability of future generations to response to them " (Pinheiro, 2006).

Sustainability is presented not only as a tool to be applied in architecture and construction, but as a way of thinking of society, economy and environment as parts of a whole. These three components (society, economy and environment) are defined as the pillars of sustainability and the contribution to the development of one of them can not be dissociated from involvement on the others.

2.2. Sustainability in Architecture and Construction
The environmental impacts caused by the construction sector have revealed extremely importance in resource degradation, resulting in physical, chemical and biological changes in the environment and contributing significantly to the environmental footprint (Cysne, 2000, cited by Arrifano, 2009). This sector accounts for about 35% of emissions of gases that contribute to the greenhouse effect (Dias, 2008), which makes it essential to find solutions that minimize these impacts.

For this purpose it is necessary to meet sustainable practices that take into account all stages of life of a building: design phase, construction phase, operation phase and desactivation phase. These practices, beyond the incorporation of measures that guarantee the transformation of renewable energy to energy expenditure, are supported by the application of bioclimatic architecture that ensures passive design, which may reduce the need for energy consumption of a building from 30 to 40% (AO, 2001, cited by Torres, 2008). Passive practices go through the correct orientation of the facades, shading the areas of greatest glazing, thermal insulation and naturally ventilated spaces (Tirone, 2007 cited by Arrifano, 2009). Apart from the referred practices, the use of environmentally friendly materials (or recyclable) ensuring a high insulating performance is essential to reduce the environmental impact of a building.

2.3. Urban Sustainability
Currently, about 50% of the world population lives in cities, noting a population increase in recent years (Mestre, 2012). The proximity of services, shops and public spaces reduces distances and the need for mobility, which is an important factor of sustainability (Amado, 2005, cited by Martins, 2013). The spaces should be designed to be enjoyed by as many users as possible, because the qualified public areas should not be restricted to certain types of users. It should be sought sustainable integration of society and be ruled out any action that promotes exclusion and social injustice.
3. Understanding the Urban Nomad

3.1. Modern Nomadism and Mobility
Mobility is a reality that is in the basis of modern social and economic structure and is reflected in the organization of the daily dynamic processes of our society (Marandola, 2008). To enable economic and social relations on a global scale the need for mobility appears as a determining factor and, with the possibilities that are emerging, the concept of nomadism has a new definition. As the possibility to travel faster was growing, while being the same, distances metaphorically diminished, allowing urban spaces to expand to the suburbs of big cities. More people began to use more public space and all mobility assumed a new dynamic. Space, time and movement are three inseparable factors to the idea of mobility as a whole.

The relationships created worldwide through fast and direct transmission of information connect points of the globe that are absolutely distant from each other, giving rise to the concept of informational mobility (made possible by easy access to the Internet network system) that “enhances the movement and the meeting points in cities” (Pellanda, 2006).

3.2. Urban Nomads
The modern nomad is a doctrine of mobility with different scales and may refer, for example, to the individual who travels frequently between several countries (global scale) or the guy who lives in city and constantly changes of place (by necessity or by choice). To classify an urban nomad any social or economic class stereotype is refused.

The homeless present themselves as the most significant group of citizens that fall under the strand of urban nomadism, for the way they approach the city everyday and their nomadic forced habits. The urban situation of an homeless is the poorest situation of daily need for shelter, setting as an example for determining the requirements according to the target audience. To make a research about their situation there are analysed some studies that help understanding the dynamics of everyday life and daily needs of that kind of urban nomads.

3.3. Requirements According to the Target Audience
The set of users may include other groups as pilgrim, "urban campers" (Baumann, 2012, cited by Boer, 2014) or modern travelers without a fixed place of residence and looking for a way to experience big cities differently. Through the analysis to these studies it was possible to know some habits and practices of the target audience, allowing to define requirements that shape the piece.

According to the study of the situation of homeless the following assumptions have been set: (a) physical protection, which is presented as its greatest need; (b) mobility, by constant movement and permanent transience with all their belongings (Viegas, 2013); (c) multifunctionality, because of the need to adapt to each specific situation; (d) connection between shelters, for the importance given to community life; (e) urban design, controlling visual impact in cities that the element can create.
4. Sustainable Mobile Shelter - Proposal for a Preliminary Study

4.1. Defined Requirements
After all the research process it has been established what functional and operating characteristics the shelter must carry, now focusing the work on the design phase.

4.2. Conceptual Definition
As visual memory is common to observe the homeless, class of individuals who are part of the group that makes up the urban nomads, stay overnight in the park or public benches.

This object is used as a reference for defining the concept that gives shape to the development of the moving shelter: the piece presents itself conceptually as a park bench that accompanies the urban nomads and allows that the overnight happens in various locations.

Figure 4.3. | The idea of the shape is the image of an urban bench that, being portable, closes in on itself.

4.3. Habitability Scenarios
Starting from the conceptual idea of the park/garden bench, the object takes shape according to all the previously defined requirements. The object closes on itself and is closed on all sides, allowing privacy in the inside, which can be broken only through the small eye opening. This detail allows the user to manage the look contact that he wants to have with the outside, also enabling natural lighting during the day.

Figure 4.4. | Perspective of the proposal in three-dimensional model.

The shelter is designed to enable various types of use. While being closed, the shelter can be used to rest with the body lying down, but can also be adopted the sitting position as it it can be seen in Figure 4.5.
Opening up to the outside and running literally as a transportable garden bench, the cover that closes up the object about itself can get up and allow the use of the shelter as a bench with shading, as it is seen in Figure 4.6.

Its shape also allows the use of the object vertically, enabling activities, for instance, as dressing, to happen with ergonomic comfort.

Through the importance that the studied target audience (the example of the homeless) gives to the group life it became important to enable the physical connection between shelters without causing untapped spaces, as evidenced by Figure 4.7. This connection can occur through “back” part or through the side tabs.

The nomadic lifestyle requires that users always keep their belongings in their possession. Following this fact, the shelter can be transported while mounted object by human power using the wheelbarrow method (Figure 4.8) or, for instance, from a trailer to a bicycle (Figure 4.16).

To allow a more dynamic transportation around town, the piece can be folded and dismantled in order to settle the dimensions of approximately 1 m x 1 m x 0,6 m, as observed in Figure 4.9.
4.4. Ergonomic Proportions
To ensure a comfortable use of the shelter it has been analyzed ergonomic proportions established by Neufert (2010) and defined measures responding to stantards defined by the author. Figure 4.10 presents the shelter dimensions in order to properly respond to user comfort.

![Figure 4.10](image) | Piece dimensions according to proportions defined by Neufert (2010).

4.5. Sustainable Principles
For the development of this work the three pillars that define, generally, sustainability have been considered: social, economic and environmental. The entire project can be introduced into a general notion of social and economic sustainability: creating shelter chance to those who choose or are forced to a life without residential reference.

Environmentally the piece fits in every way in sustainable concept. The materials are selected according to their environmental performance and reusability, being also adopted passive design strategies that happen through use of the upper visual aperture to interior heating and use of inner side openings that allow air circulation (Figure 4.11). In the planning phase, every stage of life of the object were intended. After the usage the shelter is easily destroyed and its parts reused.

![Figure 4.11](image) | Scheme with passive principles of sustainability.

4.6. Structure and Materials
Structure and materials have been designed in order to be included in the aspect of sustainable development.

The materials that make up all the mobile element and with structural functions are the follows:

a. ICB (expanded cork agglomerate);

b. Paper tubes;

c. OSB (Oriented Strand Board);

d. Corrugated cardboard;

e. Acrylic;

f. Element rendering comfort in rest (incorporated mattress).

Through the section shown in Figure 4.12 it is noticeable where each one of the materials is used (identified by the corresponding listed letter).
In order to ensure the stability of the assembled piece it became necessary to think about the plates joints which rotate and allow the fold of the structure, as well as think about locks that allow joining plates which became separated during the process. To allow the movement between the plates, it is proposed that the joints happen using a type of very resistant waterproof adhesive that allows the desired rotation and prevent unwanted movement, as can be seen in Figure 4.13.

When the shelter is constructed and mounted, the closing and locking can occur through hermetic seals which make pressure on the plates and, together with the placement of a sealing rubber in the thickness, guarantee the insulation of the interior space. In Figure 4.14 is an example of the referred system.

Aiming to reach as many users as possible it is necessary to explore scenarios that address the needs of individuals with different economic power. The project is not intended only for the homeless, so the insertion of the mobile element can happen through the intervention of companies interested in urban advertising, sponsoring the production of the piece in exchange of the referred advertising.

In contrast, it is interesting to reach another type of audience with more economic power, incorporating elements that make the shelter more appealing. A technological character may be considered through the insertion of photovoltaic thin film that uses solar energy to charge mobile devices.
4.8. Urban Scenario

All the developed and presented assumptions only have practical effect if the urban impact is controlled and acceptable, because the objective of the work involves improving the visual condition of large cities. In Figures 4.15, 4.16, 4.17 and 4.18 it is studied the insertion of a shelter of this nature in urban spaces.

Final Considerations

The dissertation was focus on the development of the preliminary study for the proposal of a mobile and sustainable shelter for who has the need or want to experience the urban nomadism activity, without being focused on a specific social or economic condition. As such, the goal became to ensure the plausibility of the project through materials and techniques that ensure the structural, ergonomic and mobile feasibility of the shelter in various urban moments. It is presented a project basis that later allows to be possible the development of the shelter as implementing project.

In the case of a preliminary study, each proposed solution is presented as an answer hypothesis to problems specifically raised at any stage of the design process, being always subject to future changes.

Future issues to be addressed can happen through the optimization of solutions that ensure the economic viability of the project, such as functionality issues that could stand out through a prototype really used by citizens with and without economic power. The chosen materials may not be presented as the most suitable according to the economic subject, what can bring the insertion or substitution by others.

The central ambition goes further by proceeding with the composition of the work, aiming to develop a full-scale prototype that can prove the feasibility of the shelter insertion in urban areas.