Bioclimatic Elements for Traditional Romanian Houses

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ABSTRACT: Bioclimatic elements of the traditional Romanian houses are analysed to emphasize their characteristics with a view to adjusting them to the new social and economic conditions and to using new building solution and materials. The paper presents bioclimatic houses specific both to the rural and to the urban environment.
The approach takes into account the main factors of environmental integration, namely: orientation and location in situ; porch with greenhouse and shading effect; plane composition and global space; thermal insulation, heating and thermal inertia; ground utilization as thermo-insulator, plantation as a sunshine moderating factor. Bioclimatic rural and urban houses could be considered as a basic concept for the future development of solar architecture in Romania.

Keywords: thermal insulation, traditional house, bioclimatic.

1. INTRODUCTION

Romanian traditional houses have acquired their style in a mainly agricultural economy and in an excessive continental climate at 45° northern latitude. The most important characteristics are the following:

- Orientation relative to the shining of the Sun and to the direction of the dominant winds;
- Solar energy collection for heating by greenhouse effect;
- Minimizing the quantity of conventional fuels used, through a proper design of the house and of the stoves;
- The use of shading elements in the warm season

Romanian traditional houses have included all these characteristics since the 19th century [8], [9], but the primary ideas of their conception are a few centuries older.

2. TRADITIONAL RURAL HOUSES

2.1 Natural Environment

The traditional rural houses in Romania are the product of two main factors: the natural environment with an excessive continental climate – frosty winters and torrid summers – and the human creative nature. Romania is under the influence of the dominant winds from the north-west, which, in contact with the humid air of Mediterranean origin, determines snowstorms. The climatic differences between different regions are not essential. However, the Carpathian mountain chain induces some climatic differences between the region of the sub-Carpathian hills and the lowlands as well as between Moldova, the Danube Plains and the Transylvanian Plateau.

2.2 Social Environment

The social environment is defined by the mainly agricultural character. The rural habitat is the product of an anonymous collective creation, consequence of a long evolution and accumulation of existential experiences.

The social background is defined by the following aspects: a limited division of labour, most of the products being the result of the efforts of the entire family, resulting in the complex development of the individuals; the relative isolation ensures a unitary character to the handmade creation, and there is an interdependence of the various occupations such as sheep and cattle husbandry, agriculture, fruit and vine growing.

2.3 Environmental Integration: Bioclimatic Functions

- Orientation and placing on site;

The main face of the houses is always oriented towards the south; this is a strictly observed rule. On the south façade are placed doors, windows and the porch – all along the house, the porch being architecturally and constructionally integrated into the house. (Fig. 1)

The north façade, facing the dominant winds, is opaque and completely closed. (Fig. 2)

As a consequence of this rule, there is a free house positioning, which does not take into account either the street and access ways infrastructure or the slope of the land.

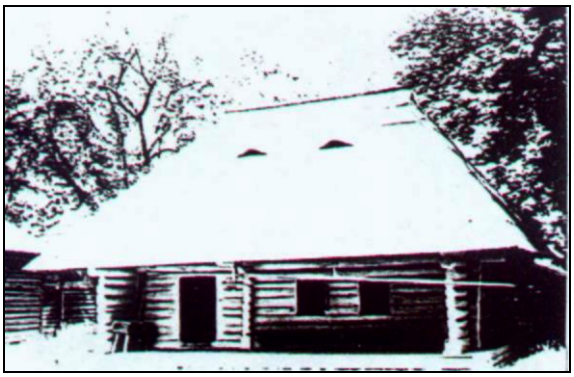

Figure 1: 18th century peasant house – Straja village, Suceava County; exhibit at the Village Museum in Bucharest – South façade.

Figure 2: 18th century peasant house – Straja village, Suceava County; exhibit at the Village Museum in Bucharest – North façade.

- Porch as greenhouse and shading

The porch is the intermediary element between the inside and the outside, both from a functional and a bioclimatic point of view. Being built on the south façade, during the cold season it is closed with removable glass panels, playing the role of a greenhouse [1], [3]. In the warm season it is open and has a shading function. (Fig. 3)

Figure 3: Late 19th century house with porch closed with glass panels – Campulung town, Muscel County.

The porch depth is designed based on the Sun's annual revolution, so as to permit the rays of sunshine to penetrate into the house in the cold season, and to stop them during the warm season. (Fig. 4)

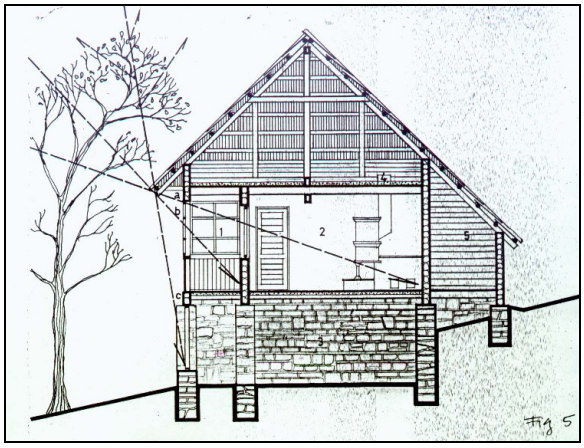

Figure 4: Prototype of a house in hilly regions

Porch closed with glass panels – greenhouse effect; Semi-basement, food storeroom; Chimney with outlet directly in the attic; Annexes, pantry (on the right). The lines represent the rays of sunshine at winter solstice (entering the rooms), at spring and autumn equinox (entering the porch) and at the summer solstice (outside of the house).

The porch is a representative architectural element with multiple bioclimatic and social functions. It also contributes to the aesthetics of the house.

- Plan composition and global space

Within the great regional architectural diversity, the plan composition remains the same all over the country. On the south façade, the one protected by the porch, there is the front door leading into the "entrance hall", which is usually without ceiling, integral with the attic. On both sides of the "entrance hall" – east and west – are the inhabitable rooms. Generally, the room on the east is in constant use; the other one, on the west, also called "the big" or "the clean room", is usually the guest room. On the northern side, with access from the entrance hall, is the pantry, running the entire length of the house. In the hilly regions, the pantry is at semi-basement level, with entrance on the south side, built from natural stone masonry and serving for the storage of wines, fruit and vegetables. (Fig. 3 and 4). The compact plan composition reflects the adaptation to the climatic conditions, the porch on the south side being a moderating factor between the inside and the outside. This layout permits the provision of a single fireplace. For this kind of solution, one can adopt the notion: "global space" [2].

- Heating, thermal insulation and thermal inertia

Thermal isolation is achieved by using materials with high a thermal transfer coefficient and with good thermal inertia. The walls are built, depending on the region, of burnt or unburnt bricks; massive timber trunks, with a layer of clay at the inside [5].

For ceilings and floors, the thermal isolation is provided by a layer of clay reinforced with twigs and straw, leaning on the timber resistance joists of the ceiling and of the floor. (Fig. 4)

The attic has a complex thermal isolation function. The chimneys coming from the fireplace do not penetrate the roof, ending up in the attic. The smoke goes out slowly through the attic covering (made up of reed, straw, shingle, clapboard or roof tiles). In the cold season, the roof is covered in a halo of smoke. The common space between the "entrance hall" and the attic – only the inhabitable rooms having a ceiling – evens out the temperature.

The attic is not only a thermal buffer but also the space where the smoked meat is stored. The smoke passing through the organic material covering helps to protect it against moisture. The slope of the roof covering varies between 30° and 60°, depending on the nature of the covering as well as on the rainfall regime, in order to diminish the snowfall on the roof. During the cold season, food is prepared on the stove or in the oven, which is part of the wood-fuelled heating stove. The chimney is intentionally bent in order to radiate heat on an as large as possible surface.

3. TRADITIONAL URBAN HOUSES

Having in view the bioclimatic functionality, Romanian traditional houses of the urban area in the 19th century represent an enhancement / adaptation of the rural houses [7]. This happened mainly due to the merchants' class, most of them moving from the countryside and bringing with them into the urban areas the tradition of the rural houses together with the local craftsmen. It is difficult to determine external influences, because the same functions lead to similar solutions in various parts of the world. The existence of porches from Japan to the United States makes it impossible to estimate any influence.

Main similarities:

- The porch oriented towards south, closed in the cold season by removable glass panels which generate the greenhouse effect, and in summer acting as a shading element.
- The tendency of the north sides to be as closed as possible in front of the dominant winds.
- Planting trees in front of the south side in order to stop sunshine rays during the summer.

The main characteristics differentiating urban traditional dwellings are the following:

- The ever increasing complexity and variety of the architectural solutions adopted in residential areas (Fig. 5 and Fig. 6)

Figure 5: South façade and inside porch, Theodor Pallady Museum, Bucharest – built in 1760 and restored in 1822

Figure 6: South façade of a dwelling built in the late 19th century, Campulung Muscel

- Adaptation to the urban system of roads. The street front is very dense, closed, shop close to shop, but the residential part, behind this, preserves the traditional bioclimatic characteristics. (Fig. 7)

Figure 7: South façade of a dwelling placed behind the street front with shops, built at the end of the 19th century, Campulung Muscel

- The use of bioclimatic elements in the design of some hotels in the 19th century in Bucharest. (Fig. 8)

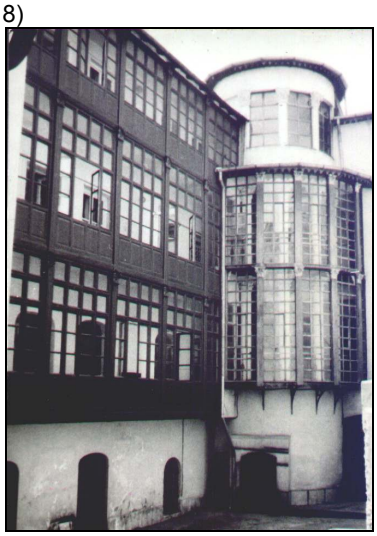

Figure 8: Former Fieschi hotel built in 1858 and restored between 1975 and 1977, Bucharest, Sun Street

4. CONCLUSIONS

The analysis of the traditional rural house in Romania highlights the bioclimatic functions of the building and implicitly its integration into the natural environment as an organic and aesthetic element, harmonizing the inside with the outside.

This premise is supported by the characteristics discussed above:

- Orientation
- Porch on the south side with multiple functions
- Global composition of the plan
- The use of local building materials with a good thermal transfer coefficient and with high thermal inertia.

These characteristics can be found all over the country and they were defined and generalized in the second half of the 19th century. At present, this tradition is loosing its importance under the impact of the on-going social and economic changes as well as of the new materials and technologies [4] and [6]. As a consequence of this valuable tradition, the bioclimatic elements are still partially integrated in the architectonics, but at a lower rate.

Analysing the achievements in contemporary bioclimatic architecture with passive systems, initiated in the 1970s, after the start of the energy crisis, one can detect the application, in other countries, based on scientific evidence, of the same principles as the ones applied in the traditional rural houses in Romania, obtained empirically, as a result of the anonymous collective creation.

Solar energy collection with passive systems seems to be possible in bioclimatically integrated housing at a reasonable cost. This solution proved to work in traditional bioclimatic houses (in Romania and not only).

Reducing the use of conventional energy up to 40 – 50% remains an achievable goal.

Urban planning of residential neighbourhoods taking into consideration the use of solar energy for passive heating proves to be a permanent objective in architecture. Though, some difficulties appear in the large-scale application of this principle, because of the following reasons:

- Indifference due to the lack of knowledge about the problem among planners and authorities
- Absence of urban planning taking into account the efficient use of solar lighting.
- Absence of projects dealing with passive solar energy collection on the facades of collective residential houses. Such an action could be combined with the improvement of the thermal isolation of existing buildings.

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