65. Initial approach to the bioclimatic aspect of the Vegaviana settlement (Cáceres)

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Abstract Vegaviana, besides being a model of the Spanish modern architecture, is the best known village designed by José Luis Fernández del Amo for the National Institute of Colonization (INC), among which can be fundamentally stood out due to its evident aesthetic and plastic quality. However, the design goes beyond the compositional values responding to criteria linked to location and climate, illustrating the environmental involvement of the architect. This new look fits in with the new research on architects of modernity as recognized as Le Corbusier who highlight the relationship of some of his works with the climate. Therefore, the main objective of this article is to analyze the possible adaptation of the houses in Vegaviana in relation to the climate, from the current bioclimatic point of view. The approach is based on the study of both the climate and the climograms of Olgyay and Givoni for the climatic data of the studied village, comparing the strategies obtained in the climograms with the architectural and constructive configuration of the dwellings type C, the most representative ones. It is expected to verify that the strategies obtained from the climograms of Olgyay and Givoni for the climatic data of the village can be reflected in the architectural and constructive configuration of the dwellings type C. It is expected to conclude that there was an environmental concern on the part of the architect embodied in the dwellings designs, linked to the concept of what we know nowadays as bioclimatic architecture.

Keywords Vegaviana, Bioclimatic, Settlement, Approach

1 Introduction

New lines of research that establish original views on the link of environment and climate with the modern architecture, even among great figures such as Le Corbusier in his work in Ahmedabad of the Palace of the Spinners (Requena Ruiz, 2012), are emerging to expose the concern of the architects of the time.

The settlement of Vegaviana, designed by the architect José Luis Fernandez del Amo in the 50s, is a Spanish modern architecture icon praised due to its plastic and aesthetic design on innumerable occasions. A defining aspect of his being is his link to climate and location which are illustrated by the architect in his writings.

In this sense, the architect José Luis Fernández del Amo shows his interest for the place and climate of Vegaviana in his writings: "… it has been conceived taking into account absolutely current and universal recognition concepts, avoiding the monotony and the superficial and false character that I had offered if I had applied general and different rules from the own functions that are the objective of this new settlement and from the weather conditions and the special idiosyncrasy of the settlers "(Fernández del Amo, 1958). Nevertheless, this significative characteristic has been overshadowed for ages because of the outstanding composition, plastic and aesthetic aspects of its architectural design.

Emphasising this environmental concern, the aim of this article is to analyse the relationship of Vegaviana with the climate and the reflection of itself in the design of the dwellings from the current bioclimatic point of view. This initial approach is based on the dwellings type C for being the most representative ones of the settlement.

Fig. 1 Dwellings type C in Vegaviana with washerwoman (Kindel (Joaquín del Palacio))

However, the bioclimatic concept from which the houses are analysed in this article, that let us distinguish the concern for linking the place with the architecture, was a completely nonexistent concept during the design period of the settlement, in 1954. Even so, the architect wrote in his work in general that "…pairing inside outside as a conjunction of the internal and outer space for a common and ideal experience depending on each one: building and environment" (Fernández del Amo, 1983).

In this way, our model to define the concept of bioclimatic is the following one: What else can be the bioclimatic approach but the effort to understand a place, with its physical and climatic determinants, but taking us the historical, cultural and aesthetic aspects as well to develop the architectural action? What else can characterise more the worried architect about the environmental situations than working over natural microsystems without damaging them? (López de Asiaín, 2001).

2 Vegaviana: the settlement in its natural environment

The settlement of Vegaviana is located to the northwest of Cáceres. It arises in a small slope towards the Tinaja stream – at the feet of Moraleja and Hoyos and next to the cattle route of the Cigarro Stream, being part of a INC national planning project. The aim was to exploit these lands of irrigated crops, after an important investment in the construction of the Borbollón Reservoir, together with a diversion dam, canals and ditches to make possible the watering.

Its proper environment is typical of Extremadura, the grassland, that is now regarded as an ecosystem to protect for being considered a rational example of the use of natural resources, result of of the interaction of man and its livestock into the woods. And the thing is that Extremadura, Portugal and Italy, to a lesser extent, are the only places where this type of forest exists.

Fig. 2 Aerial view from Vegaviana to 1958 (Servicios Aéreos Norte)

Such an environment gains much importance during all the project. Even in the chapter of the memory project, dedicated to the implementation of works, emphasising the protection of the woodland, leaving proof of the need in order that the contractor promised not to cause damages to the vegetation, neither during the works nor by the workers.

Originally, the dwellings were only separated from the land in its natural state by a small pavement that tries make easier the communication and the accesses, although the strees of the settlement are currently paved. Besides that small paths, only the roads are paved.

3 Approach to the bioclimatic aspect of the village

3.1 Materials and methods

3.1.1 Climate analysis

For this analysis, we take as a reference the data of the summary guide to the climate in Spain, carried out by the State Meteorological Agency. The data, that we take, were obtained between 1961 and 1990, a period near the fifties in which the settlement was designed.

Among these data, it can be deduced that the mean minimum temperatures begin to be higher than 9 degrees from May, and they do not lower until November, so the warm days are concentrated these months. The mean minimum temperatures of the coldest days take place, therefore, the rest of the months, from November to April, getting the lowest minimum mean in January with 3.6º degrees.

Table 1 Climatic data of Cáceres from January to December obtained from the summary guide to the climate in Spain (State Meteorological Agency). (Charts made by myself).

Month/data	Mean max. temp. (ºC)	Mean min. temp. (ºC)	Thermal oscillation (ºC)	Hr (%)	Hr max (%)	Hr min (%)	Average monthly rainfall (mm)
January	12.0	**3.6**	8.4	77	**100**	57	67
February	13.5	5.0	8.5	73	**100**	53	43
March	17.1	6.3	10.8	63	91	44	21
April	18.0	8.0	10.0	64	95	44	66
May	22.5	10.7	11.8	57	65	30	44

June	28.9	15.6	13.3	47	45	19	29
July	**33.4**	18.8	**14.6**	**38**	**14**	**6**	9
August	32.6	18.3	14.3	39	62	25	**4**
September	30.2	17.0	13.2	45	68	30	28
October	22.5	12.4	10.1	62	88	44	54
November	15.9	8.1	7.8	77	100	57	**119**
December	12.6	5.1	**7.5**	**80**	100	**60**	85

Bold the maximum and minimum values for each item

Regarding the mean maximum temperatures that are over 25º degrees, and lead to hot days, are found from June to September, having their maximum in July with 33.4 º degrees, and being over 28º degrees all these months. The lowest thermal oscillation is of 7.5º degrees and takes place in December, whereas the highest one is of almost 15º degrees and occurs in July.

The relative humidity oscillates between the highest value of 80% in December, and the lowest of 38% in July. The rainfalls are concentrated between October and February, standing out April as well, being November the month with the highest mean rainfall, 119.0 mm, although, there is an important rainfall activity in December. The maximum relative humidities reach the 100% from November to February, and the lowest relative humidity takes place in July with a value of 6%.

However, it is important to point out that in the immediate environment in Vegaviana can present variations, although, possibly small, of this data, since the particular situations of each place can create a specific microclimate.

3.1.2 Application of the psychometric diagrams of Olgyay and Givoni

Nowadays, it is usual to use the diagrams of Víctor Olgyay and Baruch Givoni in the field of the bioclimatic architecture. It is about psychometric diagrams that

connect temperature and humidity, in which a particular confort zone is established, generally speaking, referred to some specific environmental conditions. The diagram of Olygay is designed for outer conditions – in the shade, wearing light clothing and with low muscle tone-. On the contrary, the one by Givoni has into account the construction, and presents recommendations to get inner welfare.

The first one was published in the book *Design with Climate: Bioclimatic Approach to Architectural Regionalism* (Olgyay, 1963), whereas the second one in *Man, Climate and Architecture* (Givoni, 1969). Although, both of them appeared after the fifities, a time when, as we have previously mentioned, the settlement was designed, we take them as reference to analyse, from the current bioclimatic architectural point of view, the interest in the environmental aspects that the project had. Only the passive strategies will be taken into account to find solutions in an approximate epoch to the design of the settlement.

Applying the previous climate data, the relative humidy and temperature conditions place May, June, August, September and October in the comfort zone of the diagrams, but only at certain times of the day, since the defined points due to the mean maximum and minimum temperatures and the maximum and minimum relative humidities are outside the comfort zone, except in May and October, that can be inside of this for the mean maximum temperatures and the maximum relative humidity.

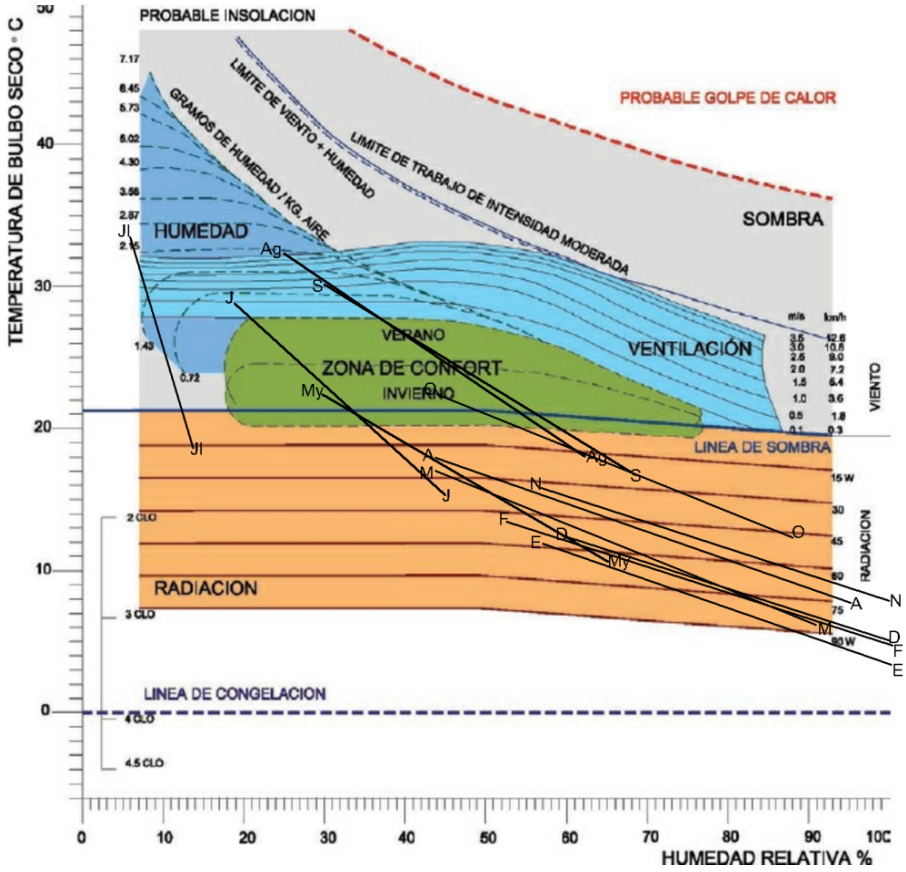

Fig. 3 Climogram of Olgyay with information about Cáceres climate (Inclusion of data made by myself)

Nevertheless, although from May to October, except in July, we find a warmer time with some moments in the comfort zone, some actions like the passive solar heating at times of the lowest temperatures in May and October, as well as the natural ventilation cooling, cooling for high thermal mass with night cooling on some occasions, and evaporative cooling, at the times of the highest temperatures in June, July, August and September, besides solar protection in the moments of the highest temperatures from May to October, will be necessary. Between November and April, months in which the comfort zone is not reached at any moment of the day, passive solar heating is also important.

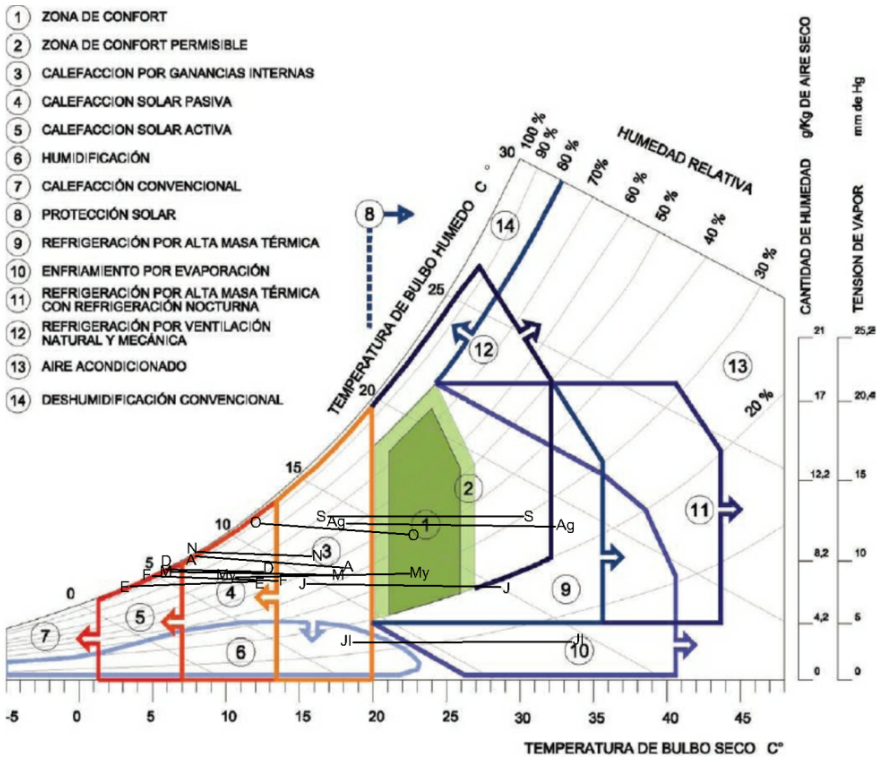

Fig. 4 Climogram of Givoni with information about Cáceres climate (Inclusion of data made by myself)

In addition, as complementary strategies that favour the ones obtained from the diagrams, we can define some of them in the following way: The essential one would be reduce the exposition to solar radiation in the hottest months, for instance, generating shadows, building compact settlements – it is fundamental to use thermal inertia-, painting the outer surfaces light colours in order to reflect solar rays or including insulating spaces, above all, on the roof, due to the fact that it is the most exposed zone to solar radiation in summer. With regard to outer spaces, it is necessary that they are designed small and protected to avoid an excessive permeability to hot day air in summer, and reducing the necessity of cooling. It is also recommendable the inclusion of transitional spaces that help to control the external climatic conditions.

4 Case study results: bioclimatic strategies in dwellings type C in Vegaviana

Due to the fact that it is an analysis of an initial approach, the planimetries and the construction details of the dwellings type C (Fig.5 y 6) are considered own of the original design without taking into account its different orientations, since they are organised in various configurations and orientations in the settlement. The strategies obtained from the climograms are analysed, and it is checked, comparing with these planimetries and constructive details, how it is possible that all these elements are achieved, except the evaporative cooling, since there is not body of water near the houses (see Fig.2).

In this way, the common characteristics of architectural and constructive configuration of the dwellings type C could let the obtained strategies in the psychometric diagrams be carried out:

1. Thermal inertia through 40cm thick walls of slate masonry in a compact settlement.

2. Natural ventilation and passive solar heating: outer spaces that allow natural cross ventilation and natural lighting, and therefore, making possible to use the thermal energy that provides the sun through outer spaces.

3. Complementary strategies: Transitional spaces between the outside and the inside, chamber insulation on the roofs, small outer spaces and light colours on the facades (see Fig.1).

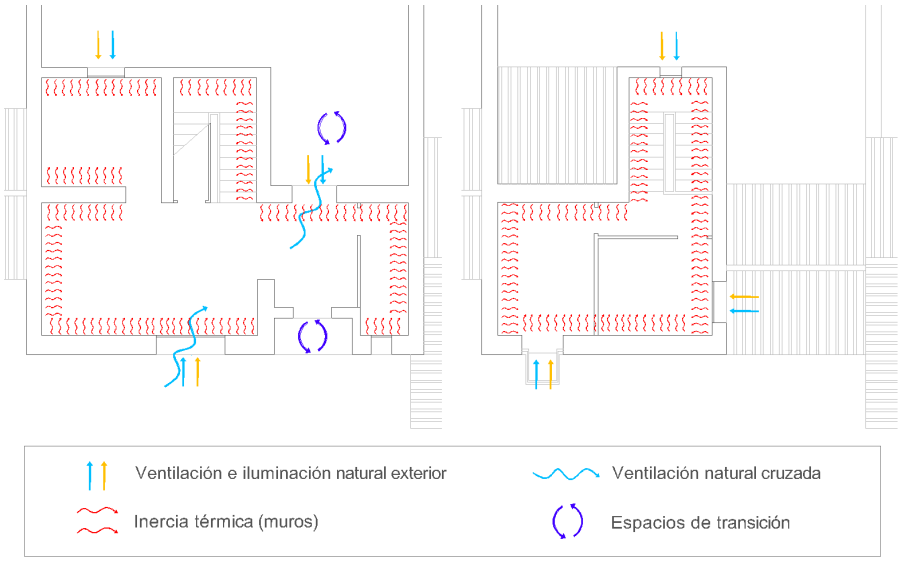

Fig. 5 Diagram of the possible bioclimatic strategies on the floor; left ground floor, right top floor (Made by myself taking as a reference the original plans of the design)

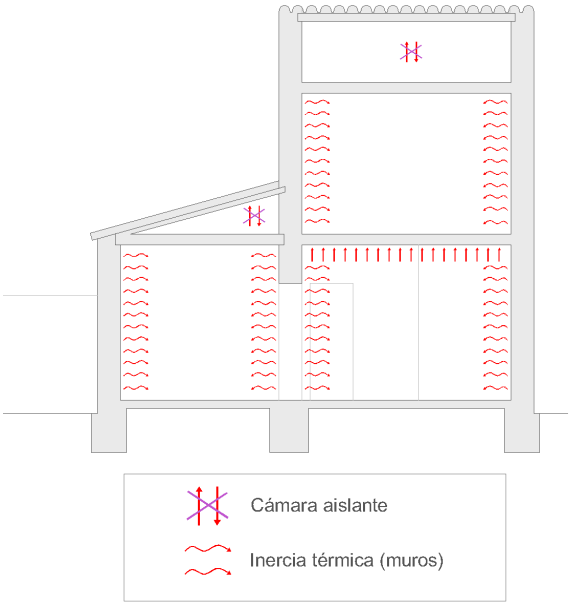

Fig. 6 Diagram of the possible bioclimatic strategies in cross-section (Made by myself taking as a reference the original plans of the design)

5 Conclusions

Taking into account words such as the bioclimatic architecture to analyse a work of the fifties, it needs to establish relationships among both realities like the worry for the climate and the location that begins to appear in the architects of the 20th century.

Making this initial approach to the analysis of these dwellings type C for Vegaviana by José Luis Fernández del Amo, from the point of view of the current bioclimatic architecture, lets us conclude that there was possibly a worry for the environment by the architect that was reflected in an intrinsic way in the design of the houses responding to the necessities of the climate of the area.

This article supposes a starting point to analyse more exhaustively the possible link between the environment and the design of the dwellings in Vegaviana, that could allow the reinforcement of the results obtained and distinguish their intrinsic environmental features more clearly.

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