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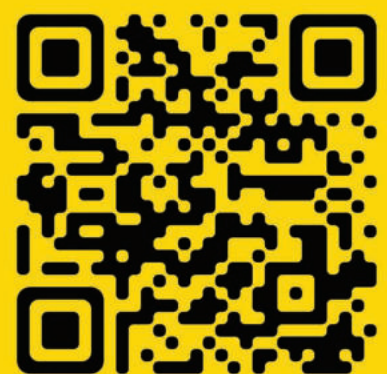
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Post-occupancy evaluation of the neo-vernacular "courtyard" in contemporary mass housing. Case study: 124 duplex dwellings by the El Miniawy brothers in Biskra (Algeria)

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Abstract. In the vernacular housing, the courtyard is the main structural space, whether by its location, function, or symbolism. The experience of El Miniawy brothers in their project "124 logements CNEP" at Biskra with its typology was promoted as "the alternative" to the conventional and traditional "courtyard house." It was reformulated as a new multi-housing typology. Their approach is based on the conversion of the traditional house's organisation around the "courtyard" from a horizontal to a vertical one in the contemporary house. This vision is argued by its designers as being inspired by local life way, to reformulate the "courtyard" space in a contemporary living environment. The present paper is an investigation that aims to evaluate this experimental project and see if it succeeded in convincing its residents as an alternative to both conventional contemporary housing and vernacular one. The study is based on two approaches. A literature review of the architects' arguments to promote the typology they suggest and a post-occupancy evaluation (POE) of their project, applied in two steps. The first is observation through architectural surveys and photography, and the second is a questionnaire distributed to project residents. As a main result of the confrontation of the environmental intentions of the architects, with the results of the post-occupancy evaluation, the study showed that the conceptual approach adopted for these "courtyard houses" did not give the results expected by its designers. This was manifested through several parameters studied, but mainly by the declared uses, which are very restricted compared to those provided by the courtyard in the vernacular habitation.

Keywords. Courtyard, Post-occupancy evaluation POE, Neo-vernacular approach, Housing, Questionnaire

1. Introduction

Nowadays, vernacular architecture is often seen as a reliable source of inspiration for any approach which seeks to be contextual and respectful of the environmental and sociocultural dimensions.

One manifestation of this vernacular architecture is the "house with a courtyard", a typology that was very common, particularly on both sides of the Mediterranean, with morphological variations related to the geo-climatic and socio-cultural contexts [1]. Several reformulation experiments of this "courtyard" space have been conducted in various Maghreb regions in line with the above concept. According to S. Abdulac [2], these experiences occurred in Algeria throughout the first half of the twentieth century during the colonial period. He enumerates the most significant ones, that have marked this period, such as the indigenous city of "Sainte Corinne" in Algiers, designed by the architects Guérineau and Bastelica in 1937. He also mentions "La Cité Scala," built near the "Femme Sauvage" ravine by Lathuillière in 1935; "Recasement City," built in Algiers, at "Climat de France", by architect Socard in 1951; and, shortly before independence, the construction of some "suspended patio" buildings, such as those in the vicinity of Blida and other patio dwellings, built by Jean Bossu between 1955 and 1962 as part of the reconstruction of Orléansville (now known as Echlef), in addition of twenty-one homes designed, during the 1960s, by André Ravereau in the M'zab village of Sidi-Abbas.

This trend has persisted after independence. It has taken a voluntary approach, valuing all elements of citizens' daily lives, including their living space. In this context, the Algerian government has enlisted the assistance of two Egyptian architects living in Algeria, the brothers Abderrahmane and Hani El Miniawy, to develop a more contextualized vision that takes into account both physical and economic elements, as well as local sociocultural references. They operated in several locations in Algeria, as their contemporary projects took place in M'sila, El Oued, Ouled Djellal, and Biskra.

Their project "124 CNEP" located at the city of Biskra in the "ZHUN Ouest", caught our interest since its typology was promoted as "the alternative" to the conventional and traditional "courtyard house". It was reformulated as a new multi-housing typology. Their approach is based on the conversion of the traditional house's organization around the "courtyard" from horizontal to a vertical one in the contemporary houses. This vision is argued by its designers as inspired by the local life way to reformulate the "courtyard" space in a contemporary living environment.

Further to our post-occupational evaluation of this project, we observed that this vision appears to be debatable on a number of criteria, despite the fact that these criteria are supposed theoretically to make their prospective strengths.

This investigation is based on two dimensions: first, an examination of the theoretical foundations of the architects' vision for vernacular-inspired modern "courtyards." It takes into account the archives written by or about them and their project. The second dimension is an investigational strategy employing questionnaire and observation techniques to assess the new courtyard's features which make the vernacular one so effective in social and thermal terms.

2. The "courtyard" a "space" to identify

Shelter, dwelling, and now "smart home" all fall under the global term "housing" which is essential to human life [3]. Oxford's Dictionary [4] defines courtyard as: "an open space that is partly or completely surrounded by buildings and is usually part of a castle, a large house". The courtyard house is one of the oldest dwelling designs, specifically, built as a shelter from harsh weather. Its use dates back more than 5,000 years, having first appeared in the Jordan valley, in the Middle as well as in China. So, common in hot and warm climates, traditional courtyard houses can be found from East Asia to the Mediterranean [5] (Figure 1). As they have been related to hot-dry climates, and when mechanical alternatives were not available to regulate the thermal ambiances, this housing typology form was the best available option to

enhance passive cooling in these hostile environments [6], offering a wide range of benefits for interior climate, including heat regulation, natural air conditioning, and methods for increasing access to natural

light [7] [8] concluded that the courtyard typology can be characterized by: economic, psychological, religious and cultural, environmental, functional, attributes (Figure 2).

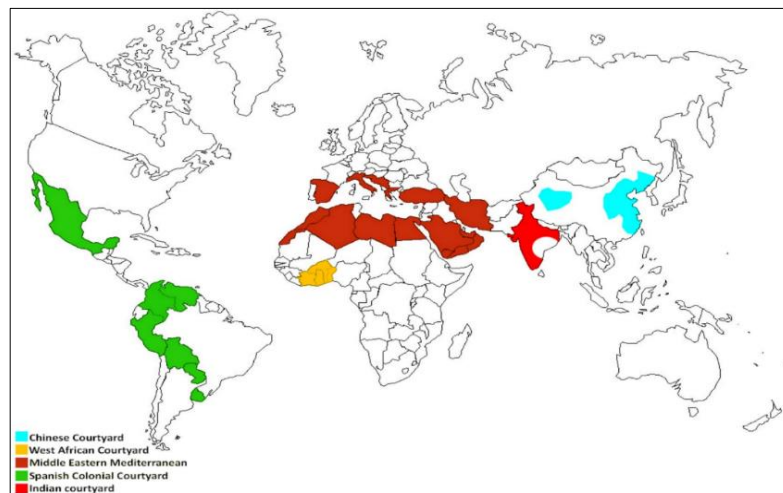


Figure 1. Presence of courtyard houses in different zones of the world
(Source: Soflaei and al, 2020)

As they have been related to hot-dry climates, and when mechanical alternatives were not available to regulate the thermal ambiances, this housing typology form was the best available option to enhance passive cooling in these hostile environments [6], offering a wide range of benefits for interior climate, including heat regulation, natural air conditioning, and methods for increasing access to natural light [7]. In addition to the precedent benefits, and according to S. Saad [9] “The courtyard might be the house's focal point that strengthens the inter-relationship of the family members It might be helpful in climatic control, social activities, architectural solution to site conditions and/or as an aesthetic provider”. For the same purpose, Swasti, and Bandyopadhyay confirm that, generally, the courtyard's inward shape gives seclusion and privacy to the home inhabitants.

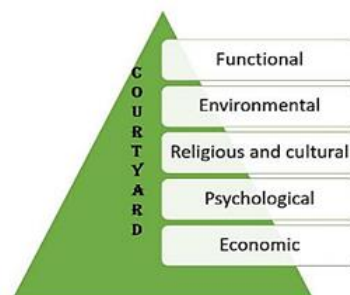


Figure 2. Different attributes of the courtyard (source: Gupta & Joshi, 2021)

They also present this space as the core of the home, where many activities take place, and as an "outdoor room" it may be used as an extension of the kitchen or living area which allows family members to connect. Organizing all rooms around the courtyard offers a direct indoor-outdoor connection. This layout fosters family courtyard usage. Courtyard homes prioritize privacy. In most courtyard residences, screened or walled entrances obscure the courtyard and give visual and acoustic seclusion, as it also absorbs noise. The surrounding rooms reduce the noise between the house's heart and the street. This creates a calmer, private outdoor environment [10].

It should be noticed that the courtyard took various shapes and forms related to the variation of many parameters as the geographic location, sociocultural context, characteristics of the site and many other parameters (Almhafdhly & al). According to R. Gupta & M. Joshi ... "The basic courthouse comprises of the following components: The court - Semi-enclosed arcade or veranda - The rooms" [8]. In the other hand and according to Edwards & al (2006), the shape of the courtyard can take many configurations as illustrated in (Figure 3) [11].

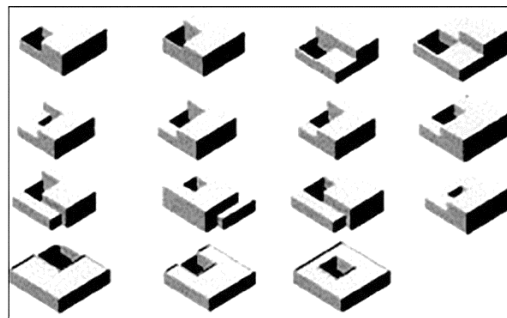


Figure 3. Different possibilities of courtyard shapes of one level and two levels
(source: Edwards, 2006)

In fact, according to Almhafdhly, studies of the architectural form of the courtyard proved that it could have a deep impact on the microclimate of its environment. Although, he says, for instance, that numerous academics have examined the influence of the standard rectangular courtyard design in hot or temperate climates on environmental efficiency. In the same way, he cites Aldawoud (2008) and Tablada et al. (2005) who advocated protection of the surface form and its surrounds from high solar radiation and hot dusty wind, in addition to the cross ventilation idea, which has a direct effect on thermal comfort [12]. For the same purpose, Meir et al. (1995) examined the influence of a courtyard with three sides on the microclimate, he concluded that taking into account elements such as direction, amount of attachment, and ventilation, the courtyard produced more favourable microclimatic conditions [13]. Muhaisen in 2006, examined the influence of a rectangular courtyard's proportions (ratios and heights) in four climatically distinct regions. The simulation research investigated the link between courtyard shape and shading performance, as well as sun position and exposure. He found that the optimal courtyard height for a good summer and winter effect was determined to be three stories in hot humid climates, two stories in hot dry and temperate climates, and one story in cold climates. Therefore, courtyards in hotter regions should be surrounded by higher walls, but courtyards in cooler climates might work with lower walls [14]. Muhaisen & Gadi found that the deep courtyard offered greater interior shade in summer while the shallow courtyard performed much better in winter. The research suggests an annual calculation ratio. Regarding daylight, however, this method is not recommended [1].

This was an overview summarizing psychosociological and technical methods which studied the courtyard's significance as a structural component of housing. The environmental conscious about housing and the climatic performance of the courtyard as important housing space, added to its sociocultural efficient functions put it under light. It gave it a new value in the housing design. That encouraged many architects to give this space a second life in their housing design, after it was neglected and ignored in the near past by generations of designers. They have been inspired by the advantages of the vernacular courtyard to rethink the worth of this area, by recreating or reformulating it in accordance with the contemporary occupants' evolving needs. It was the case of the Egyptian architects brothers "El Miniawy". They adopted this approach to design their housing projects in Algeria [15].

3. Historical context of the project

At the dawn of independence, the situation of the housing sector (like many other sectors) in Algeria was very precarious both quantitatively and qualitatively. In response to this crisis, the state proposed, as a matter of urgency, the quantitative solution of collective housing estates, in large-scale operations. Of course, this was at the expense of the qualitative dimension. Thus, "standard" habitat plans have been duplicated in the north and south without taking into account the divergence of geoclimatic or socio-cultural contexts [16], without being able to absorb the growing needs of a rapidly expanding population.

On the sidelines of this approach, on an experimental basis, came the intervention of the architect brothers Hany and Abderrahmane El Miniawy with, for objective, an attempt to contextualize housing projects on the sociocultural, environmental, and economic levels., a vision of revaluation of vernacular architecture [17] qualified as neo-vernacular environmental strategies. In the case studied, the "124 housing CNEP" housing complex located in Biskra, the approach was based on the integration of the "courtyard" space into the concept of collective housing with a reformulation of the organization of the house around the courtyard. The organization of the vernacular model [11] which was once in horizontal sprawl (Figure 3) has taken a vertical direction, to formulate a housing with two or three levels articulated and oriented towards a covered and semi-open courtyard, at double height.

4. Methodology

The vernacular approach, with its specificities, has aroused the interest of several researchers with a particular interest in the evaluation of its environmental effectiveness. Research has focused on this approach through the energy performance of housing carried out by architects El Miniawy as a standard plan in the wilaya of M'sila, a geoclimatic context very similar to Biskra's one. These researchers concluded that: "the thermal behavior of housing during the winter and summer seasons, as well as the role of the courtyard in controlling sunlight and daylight [...] This efficiency has allowed protection from the summer sun, a limitation of overheating and the lowering of the temperature that helps the circulation of fresh air, thus guaranteeing efficient natural lighting inside the rooms." [17]

Following this quantitative component, the present research work sets as its objective a psychosociological approach to evaluate the outcome of the intentions of the project designers in relation to the assessments of the inhabitants (Figure 5). For this purpose, the research was based on two steps: the first step is the identification of the foundations of this approach according to the vision of their authors, in this case the architects El Miniawy. These foundations will be defined on the basis of a questioning of the declared intentions of the architects, through their own declarations. This was based on a referenced interview conducted

by the architect Sawsan Noweir for the magazine "MIMAR" [15], as well as some other writings reporting the architects' description of their approach.

The second step comes in the form of a targeted Post-Occupancy Evaluation, POE of the project, through an observation phase in the form of a work of observation of the main modifications that the dwellings have undergone, particularly those related to the "courtyard". The graphic resources used are the architectural survey as well as the use of photography witness [18]. Finally, this step is also based on a questionnaire survey that covered 30% of the population concerned.

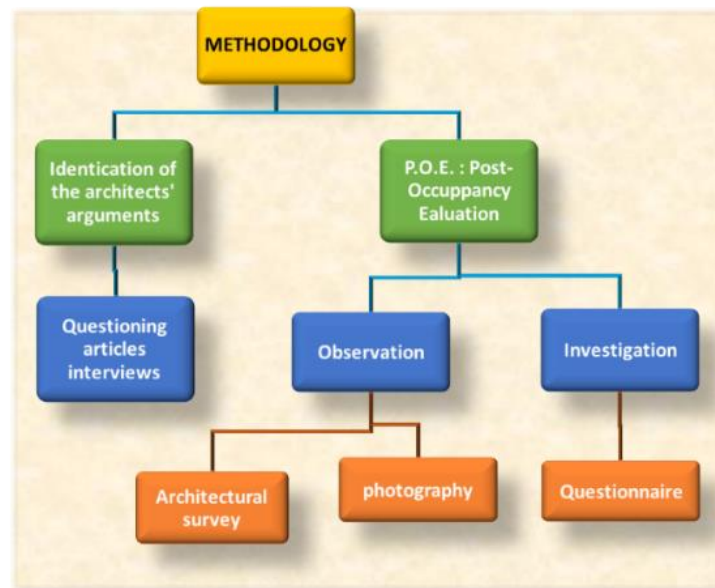


Figure 4. Methodology (source: author)

5. Presentation of the case of Study and its context

The case study is located in the city of Biskra, an oasis town in eastern Algeria, at the northern edge of the great Algerian desert, which earned it the name of "the gate of the desert". Biskra's climate is hot and dry [19] (Figure 6).



Figure 5. Biskra location (source: www.maps.com)

Its domestic architectural heritage is characterized by its typology of Saharan vernacular habitat, in the form of a house with a covered central courtyard where the rooms are organized around. This courtyard is characterized by a small opening to the sky called "rozna" allowing lighting and ventilation. This space plays the environmental role of thermal regulator but also multifunctional on a socio-cultural level [20] (Figures 7 & 8). This typology has endured through the production of contemporary autoconstructed housing [21].

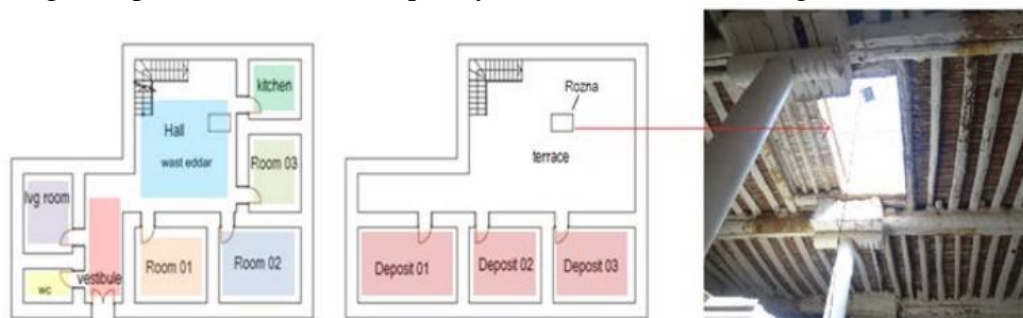


Figure 6. Example of a courtyard house - Biskra (source: barkat, 2021)

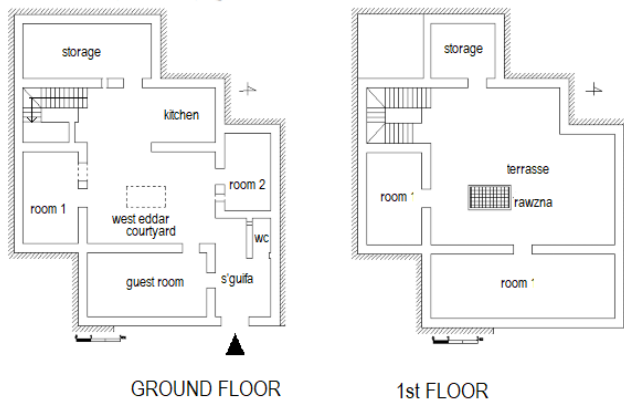


Figure 7. Example of a contemporary courtyard house - Biskra (source: Madhoui, 2019)

The studied project, the city known as “124 logements CNEP” is situated in the west side of Biskra (Figure 4). Designed by the architects El miniawy. It was realized in 1981, as an experimental case for an environmental architecture; this kind of experiences was located in several sites as M’sila, and with different typologies in Ouled Djellal, Boussaada and Oued Souf.

The city is a range of blocs aligned to the boulevard Mohamed Seddik Ben Yahia, but their entrances are oriented on the opposite side (Figure 8).



Figure 8. Location of the case study city (source: google earth, 2022)

Constituted by 124 Collective Housing, as duplex with two entrances to two different intermediate levels for each apartment. Its designers describe the project as “Each unit is built on three levels, the entrance is on the intermediate level and the reception area is located there. The lower level is the family area and the area for domestic activities. The upper level contains the sleeping quarters. These three levels are organized around a large semicovered patio which favours the creation of a microclimate. The patio also forms an organic extension of the family quarters. Together the components comprise a well-proportioned ensemble” [15]. (Figure 9)

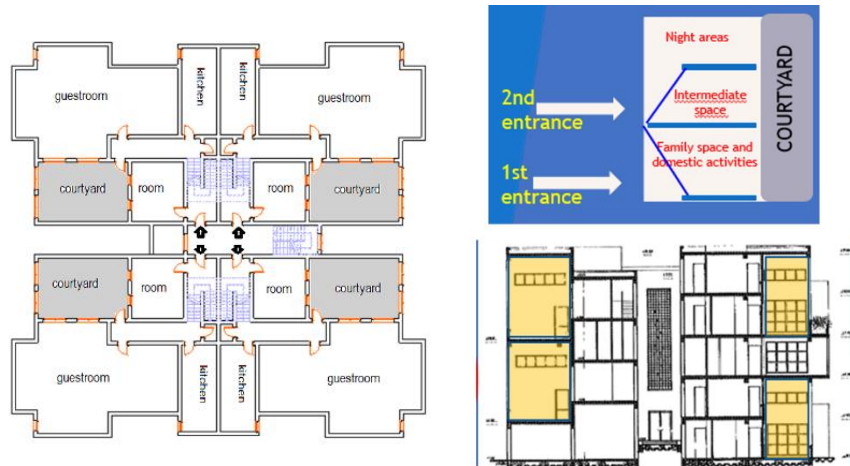


Figure 9. plan and sections of a bloc of 4 apartments

6. Results and discussion

7. An overview of the architects' stated intentions

As an introduction to this part, we should have a succinct overview on the background of these two architects. Hany and Abdel Rahman El-Miniawy. They are two Egyptian architects who made a part of their architectural studies at “EPAU” architecture school, in Algeria, before working as designers on many important projects between 1975 and 1988. So they are not strangers for the local Algerian culture. (sawsan Noweir, 1983)

As previously stated, the first stage of our research is to identify the foundations of the neo-vernacular approach as intended by its authors, architects El Miniawy. These foundations are identified through the questioning of the intentions of the architects, through their own statements, collected mainly from a referenced interview in the magazine "Mimar". This interview was conducted for the magazine "MIMAR" by architect Sawsan Noweir [15]. furthermore, another major article produced by them for the same magazine was quite instructive for acquiring a complete overview of their conceptual vision of the housing design.

The analyse of these two papers allows to focus on some paragraphs where their vision is, clearly and succinctly stated, and their approach's strategies is elucidated. It shows that they advocate:

- “A local constructive approach.”
- “An approach adapted to the environment and human socio-economic needs, conceptually adapted to the "new reality of the Arab world".”
- “From its conception, the organization of the plan would be dictated by sociocultural considerations...”
- “Conceptual approach adapted to the geographical environment.”
- “The interior space of the living units would shelter the activities that are individual and private; the common spaces would enclose a dynamic and organic ensemble of activities, that could be either individual or collective.”
- “Satisfy the fundamental needs of families, while at the same time curbing the influence of foreign models that have produced an architecture completely out of keeping with both the customs and the economic realities of the nation.”

El Miniawy brothers describe their project, in concern for our research work, in these words:

- “Each unit is built on three levels The entrance is on the intermediate level and the reception area is located there. The lower level is the family area and the area for domestic activities. The upper level contains the sleeping quarters. These three levels are organized around a large semi-covered patio which favors the creation of a micro-climate. The patio also forms an organic extension of the family quarters. Together the components comprise a well-proportioned ensemble.”
- Their "problematic concern is “how to conserve architectural heritage while developing viable solutions which meet current socio-economic needs?” then “how to provide the desired ambience within the living spaces, detailed studies of light and shade were undertaken to determine the best way to provide natural ventilation and to minimize the effects of sandstorms and heat”.

In conclusion, their approach is, obviously, an environmental vision, taking its roots from the vernacular architecture from the urban level to the architectural details one. The other major concept they based on for their housing design is that the courtyard is the organizer space of whole the house even by its location or its function.

8. Post-occupancy evaluation of the project

As it is stated by many researchers, the post-occupancy evaluation (POE) has been identified as a useful tool and criteria for assessing building performance [22]. POE is a process of evaluating the performance of the built environment, including the building, and its components after the construction of the building has been completed and the occupants have moved in. This process is executed by collecting data from the occupants of the building to analyze the performance of the building, and how the occupants are using the building. such as their perception of the building, their satisfaction with the building, the comfort of the environment, and the safety of the building (Aliyu et al., 2016). It is beneficial as it can provide feedback on the building’s performance and how the occupants are using the space, to inform any necessary changes or improvements to the design and use of the building.

For all these reasons, in the present level of this study, the POE is the perfect approach to assess this project’s performance in regard to its designers’ intentions. The POE is applied first by observation tool and next by a questionnaire survey.

8.1.1. First step: Observations on the project's present status

In this case, the observation of the modifications, applied by the residents on their homes, shows that the spatial mutations are very significant, even on the envelope or on the spaces’ organization. The “courtyard” as designed by the architects, was designed to be a substitute for the vernacular one. Currently, it is deeply transformed from an outdoor open space to an indoor closed one (Figures 10 & 11). It is integrated, partly or totally, into the other indoor spaces. In fact, the observation work of the city shows that over 80 % of the courtyards were obstructed in many ways, they were converted to spaces with various functions such as a guestroom or a 2nd room (Figure 12).



Figure 10. Left: the initial form of the courtyard Right: the various transformations of the courtyard (Source: author)



Figure 11. View showing the transformations of the city's facades by closing in different ways the open courtyards. (Source: author)

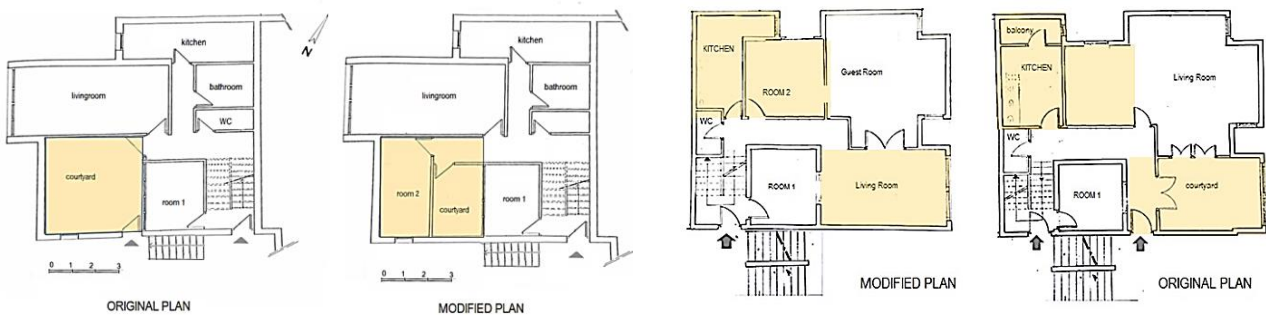


Figure 12. Examples of the deep transformation of the courtyard. (source: author)

8.1.2. Second step the questionnaire survey

This questionnaire survey was administrated to the city's residents to evaluate their appreciation of the specific design of their houses in regard of the declared intentions of the architects El Miniawy. The questions were formulated in a concise manner so that they are easily understood by the respondent. The survey covered 30% of the city's residents. From

many topics discussed in this questionnaire, this paper takes into account the results of four major significant dimensions related to their responses:

About the cognitive Dimension:

To evaluate how the inhabitants of the city, mentally, conceive their houses' courtyard space in comparison with the vernacular courtyard, the open question was simply "how do they name it, in their normal discussions?" [23]

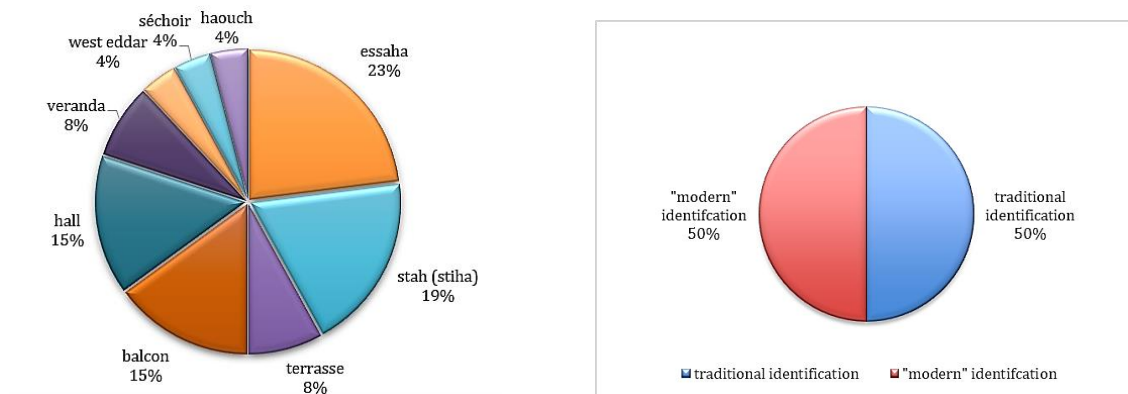


Figure 13. The designation of the courtyard (source: author)

To this open question about the dialectal designation of the courtyard, there were nine answers. the answers were equal between traditional references and modern ones. But the two first dominant values are traditional with 23% and 19%. This means that the inhabitants still make a connection between the shape of the courtyard as it's designed in their houses and their mental perception of the traditional courtyard.

Table 1. The designation of the courtyard. (source: author)

Traditional designation				Modern designation				
Essaha	stah (stiha)	west eddar	Haouch	balcon	Hall	veranda	terrasse	séchoir
23%	19%	4%	4%	15%	15%	8%	8%	4%
Total : 50%				Total : 50%				

So we can conclude that, although the concept of "apartment" refers to a type of housing considered relatively new (often modern), the names of the "courtyard" space refer to typically traditional spaces such as "essaha" and stah (or stiha), which implies, spatially and functionally, its assimilation to this space anchored in the local architectural tradition of housing.

- In the other hand, for answering the question: In your opinion, should the ideal dwelling contain a courtyard (whether covered or uncovered) or a space resembling "wast eddar"?

The results are very pertinent with very contrasting values; the affirmative answer was for 85% against 15% of negative answers.

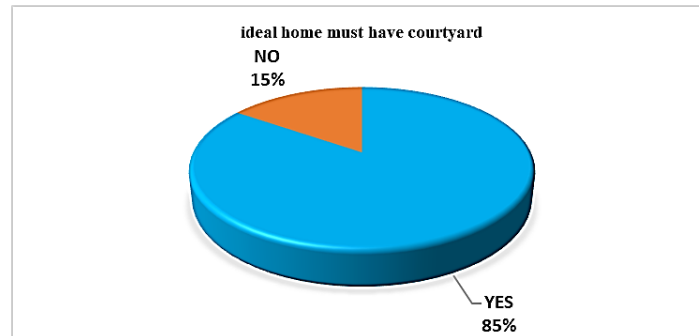


Figure 14. The results of the question “must ideal home have a courtyard”. (source: author)

These values show that the courtyard space is still a strong symbolic concept of well-being for the home. This conclusion is verified by the result of the following question asked to those who gave an affirmative answer: “If you agree, what it’s the reason?”.

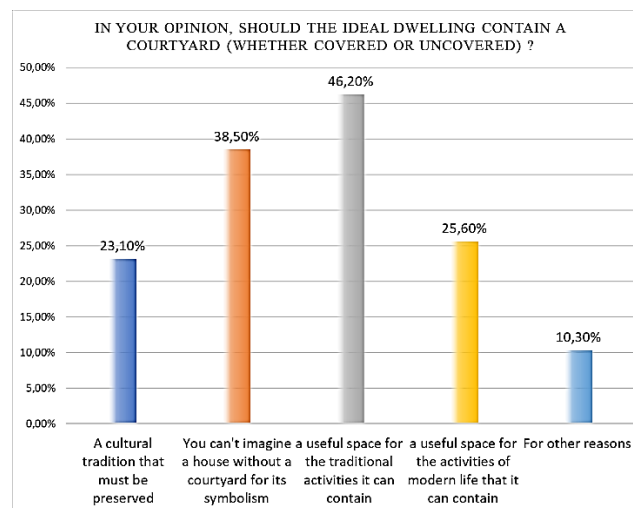


Figure 15. The reason making you agree that must ideal home have a courtyard”. (source: author)

Answers two and three have the higher score. It is stating that:

1/ “we can’t imagine a house without a courtyard for its symbolism

2/ it is a useful space for traditional activities it can contain

So we can conclude that, for the responders, the courtyard space has two major benefits: its symbolism and usefulness.

About the housing typology chosen by the project’s designers:

The question was about the inhabitants’ appreciation of the “duplex housing” concept applied to multifamily housing:

For this issue, the direct question contains the Likert scales with five levels of satisfaction: “Not at all satisfied, not satisfied, neutral, satisfied, and very satisfied”. The results show that there is a high level of satisfaction from the inhabitants of the city (Figure 16). This

design breaks out of the stereotype of the standard apartment of multifamily housing. The distribution across many levels provides an approach to the typology of individual dwellings.

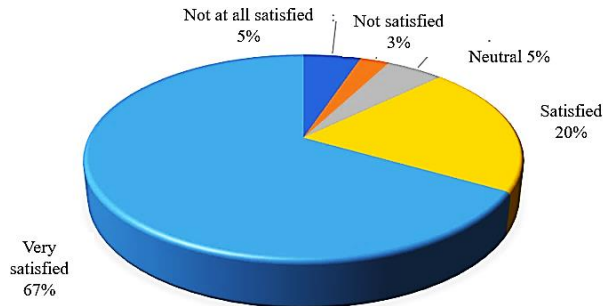


Figure 16. Appreciation of the duplex housing concept. (source: author)

About the usage of the courtyard

The survey contained also, another question about the usefulness of the courtyard, this time, in its functional aspects for the two principal seasons winter and summer. For a precise evaluation, we used five levels of frequency: “never, rarely, occasionally, often and always”.

The first major observation is that there is a dominance of the level “never” for all the activities, particularly for using the courtyard as an entrance even in the winter or in the summer. This explains why the majority of the residents removed the second house’s entrance from the courtyard.

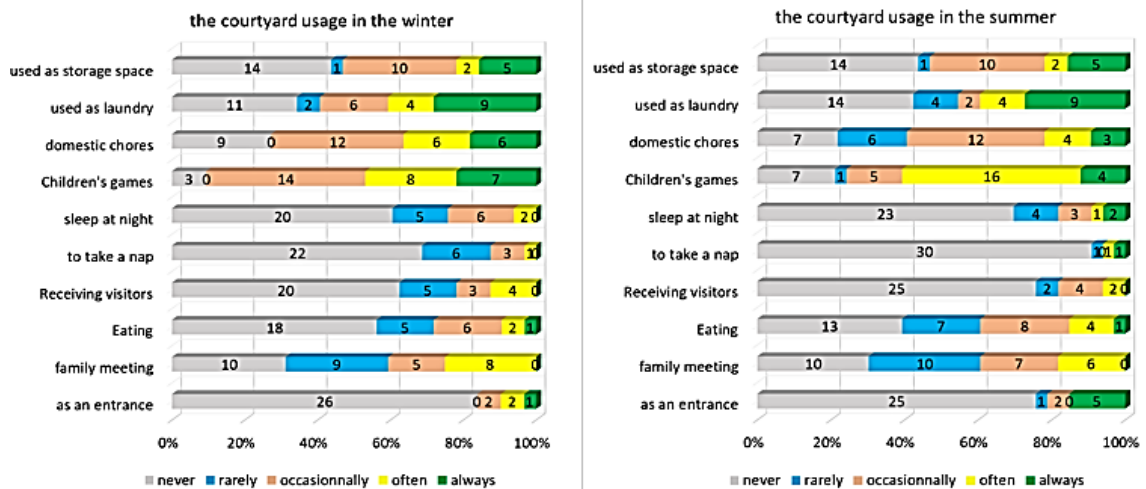


Figure 17. The usage of the courtyard. (source: author)

Another interesting observation is about to know if the courtyard is used always or often for any other activity for some of the responders. In order of frequency. In the first place, came the activity “used as laundry” in both of summer and winter. The next one is “use for children’s games” but most in the winter than in the summer. For the use for “the domestic chores” which was the main function of the vernacular courtyard, we can observe in descending order the most frequent answers were “occasionally”, then “never” then “often” and at last “always”. This can explain the transformations of this space we’ve observed in the first part of this work.

1. Adaptation of the housing spaces to the inhabitants' needs

The question was about any spatial transformations applied to the house. For this issue, the direct question contains multiple choices. The results show that there is a high score of transformations done to the spatial organization. So even the city's inhabitants are satisfied about the "original typology" of their houses, most of them have chosen to transform their spatial organisation, with a clear tendency to enlarge spaces (Figure 18).

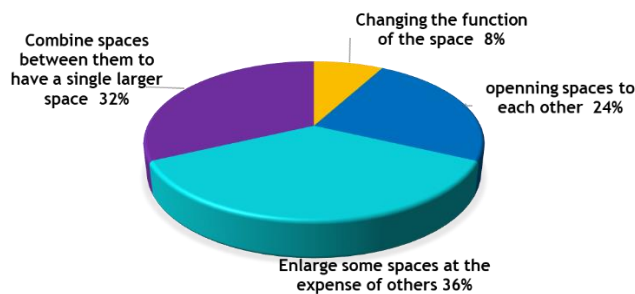


Figure 18. Transformations of spatial organization of the house. (source: author)

About the residents' appreciation of the building climatic adaptability

For this purpose, three questions helped to evaluate this criterion. The first one was to ask for the time of use of air conditioners by month. The answers show that, for four months of the year, air conditioners are used every day. These months are June July, August and September. For the month of May, it's about 80% of the month's days. Air conditioners are used even in April, October, and a few days in November. (Figure 19)

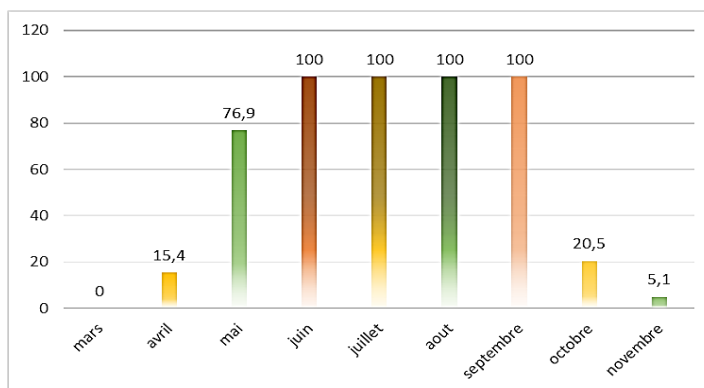


Figure 19. The use of air conditioners by month (%). (source: author)

The second and third questions are about the inhabitants' appreciation of the thermal performance of the courtyard in the summer and the winter.

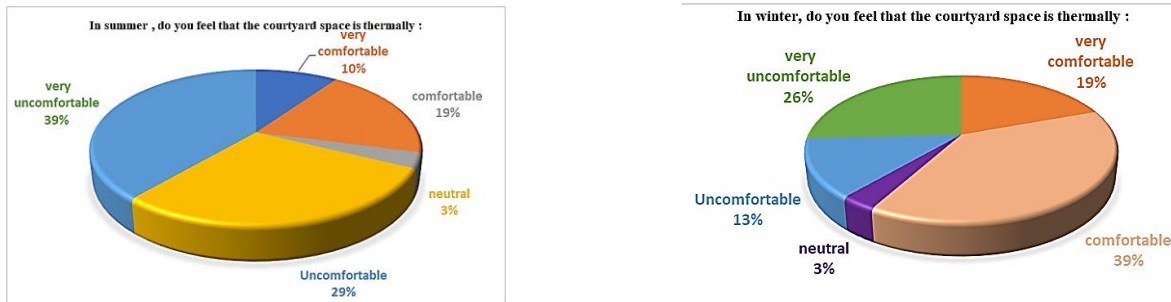


Figure 20. The appreciation of the inhabitants of the thermal performance of the courtyard in the summer and the winter. (source: author)

The results indicate that in summer 68% of the responders consider that the courtyard is an uncomfortable space against 29% who feel that it's not. In the winter season, their appreciation is more positive with a total of 58%, for considering that the courtyard is comfortable against 39% considering that it is uncomfortable (Figure 20).

All these values indicate that in the opinion of the project's residents, and in regard of their behaviours against the thermal ambiances of their home, the thermal performance of the project is not as it was claimed by its designers, in referring to the performance of the vernacular courtyard.

9. Conclusion

The experience of the architects El Miniawy in the field of environmental architecture in Algeria is still a good reference for the search of an integrated architectural production. Their approach advocated the return to vernacular know-how in the design of an architecture adapted to socio-cultural and geoclimatic contexts. It concerns several aspects of architectural design and production. Several of them have been studied by researchers in different fields and specialties. This study focused on the reformulation of a key-element of dwelling's vernacular architecture, which is the "courtyard" space. Its particularity is due to its recognized bioclimatic performance, as well as its importance, as a structuring and essential space of the dwelling. The case study chosen is their project "the 124 logements CNEP" in Biskra. The approach adopted for this study is based on two components: The first concerns the identification of the arguments of the architects El Miniawy to define their environmental approach to vernacular inspiration. This part of work was based on a literature review of what was written about and by them. The second component: is a post-occupancy evaluation POE approach, applied to this project and in particular the "courtyard" space. This POE revealed, in its observation part, the major changes that the "courtyard" space has undergone on its envelope, but also on its functions. These changes were justified in the second part of the post-occupational evaluation, which is presented in the form of a questionnaire. This survey revealed that cognitively, the inhabitants of the city are, ideally, always attached to the presence of the "courtyard" space in the house. However, in practice, they could not assume its presence as such in their apartments. This inadequacy was manifested through several parameters studied, but mainly by the declared uses which are very limited, compared to those provided by the courtyard in the vernacular habitation. Regarding the contribution of the courtyard to improving the thermal performance of housing, their negative assessment about it remains an important parameter in the results of this study because it push to review the way of designing this space in this typology of habitat. In relation to this

case study, and to conclude, the confrontation of the environmental intentions of the architects El Miniawy, inspired by vernacular architecture, with the results of this post-occupancy evaluation, showed that the conceptual approach adopted for these "courtyard houses" did not give the results expected by its designers.

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