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ENCLOSURE OF OUTDOOR SPACES IN A RESIDENTIAL ENVIRONMENT BETWEEN VISIBILITY AND ACCESSIBILITY

FECHAMENTO DE ESPAÇOS AO AR LIVRE EM UM AMBIENTE RESIDENCIAL ENTRE VISIBILIDADE E ACESSIBILIDADE

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Abstract

This article attempts to study the impact of spatial intelligibility and the visual perception of the user on his habitat and focuses on how the inhabited space is experienced, practiced, and appropriated by its inhabitants through the study of concepts affecting the habitability and use of outdoor spaces in the residential environment based on the space syntax approach. The aim is to measure the degree of visibility, spatial and visual accessibility, connectivity, and integration between one space and another. Once the diagnosis is made, it becomes possible to intervene to improve the visual characteristics of the urban fabric and landscape, towards a better fabric of the city. The results show that the living practices and the ways that the inhabitants appropriate and use the space are intimately linked to the use of visibility by the inhabitants according to the integration of the space in question, its intelligibility, permeability, and its accessibility. Ultimately, the visual perception of the landscape image of the residential environment and the use of space are too important and closely related parameters, they affect each other and are shaped mainly by the physical environment in which the resident lives.

Keywords: Habitability, residential environment, enclosure, space syntax

Resumo

Este artigo procura estudar o impacto da inteligibilidade espacial e da percepção visual do usuário em seu habitat e enfoca a forma como o espaço habitado é vivenciado, praticado e apropriado por seus habitantes através do estudo de conceitos que afetam a habitabilidade e o uso de espaços exteriores em ambiente residencial com base na abordagem da sintaxe espacial. O objetivo é medir o grau de visibilidade, acessibilidade espacial e visual, conectividade e integração entre um espaço e outro. Feito o diagnóstico, torna-se possível intervir para melhorar as características visuais do tecido urbano e da paisagem, no sentido de um melhor tecido da cidade. Os resultados mostram que as práticas de vivência e as formas como os habitantes se apropriam e utilizam o espaço estão intimamente ligadas ao uso da visibilidade pelos habitantes de acordo com a integração do espaço em questão, a sua inteligibilidade, permeabilidade e acessibilidade. Em última análise, a percepção visual da imagem paisagística do ambiente residencial e o uso do espaço são dois parâmetros importantes e intimamente relacionados, eles se afetam e são moldados principalmente pelo ambiente físico em que o residente vive.

Palavras-chave: Habitabilidade, ambiente residencial, enclausuramento, sintaxe espacial

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INTRODUCTION

Being shaped by man, the built environment envelops his activities and affects his perception and use of his inhabited environment. The habitat as a system has always been the support of life and practices linked to the perceptions of its inhabitants. The concordance between these practices and the conceptual qualities of the space meeting the needs of the users has not always been ensured, especially at the level of collective housing where the appropriation of the outdoor space is done systematically and it is a function of several factors such as surface area, immediate proximity, time, etc. (1) and makes it possible to grasp the confrontation in space between urban planning practices and those of the population and thus highlight the dialectic that exists between the conditions of production and uses of space. It also allows access to forms of social recomposition of space, both in the social construction of neighborhoods and in the adjustments made to the spatial arrangements of the habitat (2). The importance of the outdoor space in the urban composition and the habitat directs toward the search for the requalification of the conditions of habitability of this type of space in collective housing.

The habitability of outdoor spaces is a concept associated with the quality of what can be inhabited. Its evaluation can be ensured by the interaction of several components translated in the form of aspirations or psychological, social, and economic criteria (3). This evaluation focuses on the inhabitants and their relationship with their residential environment. Isabelle Daëron goes further by postulating that the very idea of habitability is the action of colonizing territory and of imposing power over something foreign to it. So habitability seems to be never more than the reproduction of a singular cultural model, of a particular way of life, and a unique individuality (4). Several works have dealt with this issue from the point of view of urban form and architectural typology (5, 6, 2, 7), which appear in the metamorphosis of the urban space and which are easily observed through the typical and massive transformations of facades followed by an appropriation of outdoor spaces (8). Therefore, the concept of appropriation is used to understand user/architecture relationships and identify social and cultural practices (9). This spatial diversion turns out to be the result of the dysfunction caused by foreign pedestrian movements which pushed the inhabitants to operate through modifications of the urban space in question; thus, practices of transformations and the appropriation of outdoor spaces are observed overwhelmingly in the axes most frequented by pedestrians unfamiliar with the city (2), ranging until the neighborhoods are completely closed. The citizens who live there daily, therefore, bring a different perception and knowledge from that of the experts.

This prompted the following problem to be posed: How can habitability by enclosing outdoor spaces in a residential environment affect the visual perception of its landscape image and therefore its integration through its degree of visibility? Does it help meet users' needs in terms of safety and socialization?

The habitability of outdoor spaces and their use by residents would be intimately linked, on the one hand, to the visibility produced by the reappropriation of outdoor spaces, and on the other hand, to its attractiveness in terms of visual access; the degree of perception of the landscape image from the urban environment and the spatial configuration of the urban structure in which it is integrated affect its link with the urban structure; its accessibility, and its visual properties for the activities of the inhabitants. The perceptions, meanings, representations, and uses of architecture have become dimensions to be observed to qualify social and cultural phenomena (9).

BIBLIOGRAPHIC REVIEW

Contemporary physical and territorial frameworks are part of a societal evolution grasped by the rise of the individual, the rejection of society, and the transformation of lifestyles. The world invites itself into the domestic space through innovative and more efficient communication technologies; while the latter cuts itself off by multiplying the access barriers, and confining itself behind citadels (9). The practice of closing collective housing districts contributes to their isolation and affects the surrounding landscape quality. Eventually, fencing promotes a sense of enclosure, security, ownership, and control. While openness increases the degree of visibility and accessibility and the frequency of use, it promotes foreign pedestrian movement, transit, unfamiliar with the residential environment, and which threatens the privacy of the collective city. As a result, residents secure their urban environment through adaptive transformations (10). Various theories such as readability theory (11) and Jane Jacobs' eyes on the street (12), theories of ecological psychology (13), and Newman's defensible space (14) consider that enclosure contributes significantly to the feeling of security, control, and surveillance of the space, and therefore to the quality of life of that space, while others assert that the enclosure does not the solution to the urban problem, but the problem itself, its indiscriminate use has been at the origin of the creation of fragmentary, unintelligible and vastly underutilized spaces, which form a significantly isolated and segregated proportion of the urban environment (15) which lead to the formation of closed aggregates, barriers and "cuts" which affect the accessibility of roads, equipment and natural spaces in the city, inducing new social tensions (16).

Understanding the relationship between space and the human activity that takes place there requires a consideration of the relational aspects of space to its environment (17). The two relationships of physical accessibility (inaccessible space is unusable) and visibility (invisible space is therefore inaccessible and unusable) ensure that space interacts with its global spatial environment (18). Reflection on the visual criteria of the habitat tends to perceive the habitat in its envelope and the challenges of the representations of the inhabitants, also the existence of the relationships that take place between the habitat and its surrounding urban space. Thus, understanding the visibility and perception of people is an essential tool for producing more livable spaces (19). According to Jean Cousin (20), several factors influence the evaluation of visual perception, the degree of visibility and visual accessibility within a space, such as the types of spatial variables (configuration, position, movement, orientation, relief, and perspective) and

visual (intensity, size, color, texture, light, opacity and transparency). Visibility and accessibility have been a common subject in several studies (21, 22, 23) which have considered the relationship between visibility (what can be seen), accessibility (where people can go), and observed movement of users when using the space (where people are). But few studies have addressed the impact of enclosure on the degree of visibility and accessibility and therefore integration and permeability of residential neighborhoods in cities.

It is argued that in collective housing, “outdoor spaces with low and minimal integration values are better places to deploy activities and social interactions between inhabitants than high-value spaces”(24, p.52). Thus, the public space “with an introverted configuration and the lower degree of permeability could encourage all kinds of interactions between its inhabitants” (24, p.52). Active interaction is generally seen"as a by-product of the increased pattern of probabilistic interfaces, an increased sense of co-awareness or co-presence, leading to overt social acknowledgment" (25, p. 13). Kashef provides

> The planning and design assessment tool that is part of an overall process to draft a regulatory framework that encourages best practices in residential development. The comparison of traditional neighborhoods and new housing estates highlighted the underlying characteristics of urban spaces and habitable neighborhoods. Issues examined in this comparative analysis included intra- and inter-neighborhood connectivity, walkability, possibilities for public social discourse, sustainability, and architectural variety (25, p.15).

Yeganeh claims “that there is a relationship between territoriality and social action and the level of perception of integration between the city and its buildings in urban public spaces” (26, p.588). In another study, “residents expressed concerns on five aspects, which have impacts on the social quality of spaces, namely safety, social interaction, overcrowding, visual privacy and accessibility and hierarchy of spaces” (27, p.78).

The hypothesis of this study proposes that the habitability and use of urban spaces could strengthen or weaken the city-habitat link, thus the reappropriation of the exterior spaces of residential neighborhoods could improve or alter the visibility of spaces, and consequently, change the visual perception of the user's landscape image.

The objective of this paper is to study the correlation between habitability and the use of outdoor space in a residential environment by residents and the visual perception of the landscape image of collective housing estates. The example of the 150 housing estate (C*ité Bellevue*) in the city of Batna (Algeria), offers a variety of forms and changes in its landscape images. The landscape reading was approached through the exploration of the method of space syntax (28) constituting the interface between the gaze of anthropo-social sciences and space sciences. It is a set of techniques for quantifying, interpreting, and representing spatial configuration to demonstrate the social logic of space.

MATERIALS AND METHODS

The syntactic approach for the benefit of visibility and accessibility features

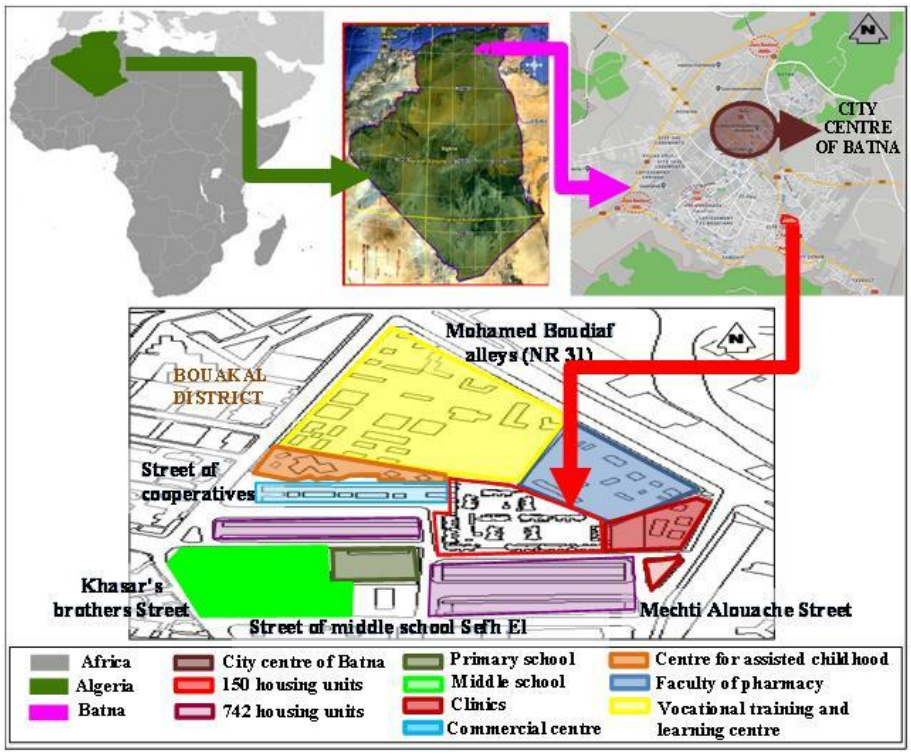
Space Syntax is a research program that explores the relationship between spatial order and social order, touching all physical environments and inhabited structures in all their various forms: buildings, establishments, cities, etc. (29). Space syntax seeks to describe, explain, and interpret socio-spatial phenomena by combining the formal aspect and awareness of social nature in a spatial system, summarizing the function and dysfunction of spaces. The essential task of this method is to find tools and means to analyze the interaction between people's behavior and spatial arrangements and configurations (30). The Depth map program makes it possible to analyze the accessibility of the space and its visibility by modeling the plans by establishing maps within which a chromatic scale appears from a magenta tinted to red (for the highest values) up to blue-tinted magenta (for the lowest values). The study was based on two urban scales, one macro relative to the spatial configuration of the city by the use of the axial map, the other micro at the scale of the district by the use of visibility graph analysis and all axial line analysis. The reading and interpretation of mapsare done through basic notions which constitute the key parameters of syntactic analysis. Thus,integration describes how a space is connected to other spaces and shows its degree of spatial permeability concerning other spaces of the system; connectivity expresses the number of connections of space about other spaces directly linked to the space considered(17), and choice represents and measures through-movement potentials spaces and it is a “measure at forecasting pedestrian and vehicular movement potentials.Spaces that record-high global choice is located on the shortest paths from all origins to all destinations”(31, p.15).The hierarchy of each space is reorganized according to its topological position defined here by the notion of depth which is the topological distance of space from the others, the number of steps through which it is necessary to pass to reach another space. The higher the integration value of a space, the less its topological distance to other spaces. (If the integration value of a space is high, the topological distance to other spaces is reduced). Conversely, the more it is segregated, the greater its topological distance from other spaces. This gives an overall reading of the most central spaces that are topologically less deep, and therefore more integrated, and naturally having a greater potential for to-movement; and the most segregated spaces, topologically deeper, and therefore less frequented (23).

Presentation of the study case

The city of Batna is located in the eastern part of Algeria; its urban growth has taken place through the creation of many neighborhoods, several subdivisions, and estates. The chosen study case is the 150 housing estate called *Cité Bellevue* (Beautiful view), which was built in the early 1.995s on the land of 16.477,75 m^2. It is located south of the city center and is surrounded by several public amenities. In the North, it is bounded by the faculty of pharmacy and by the vocational training center, in the North-West, it is limited by the assisted childhood center and by a shopping center, in the

South and the South-West, it is delimited by the 742 housing units and by a primary school, and by a private clinic in the East (Figure 1).

Figure 1:Situation plan and ground plan of "Cité Bellevue" and its delimitations.



The case study is made up of 15 blocks of collective housing buildings of a rectangular bar type of five floors. The adopted model has undergone a lot of transformations, and this expresses its rejection by the inhabitants who tried their modifications to improve their environment. The district has experienced several changes in the uses and appropriations of outdoor space affecting its landscape image regarding its spatial configuration, accessibility, and visibility. Its inhabitants have reclaimed the outdoor space of the neighborhood by making it an enclosed and invisible space (figure 2). The various transformations noted at the estate level are:

- The realization of the enclosing walls on the empty pockets between the buildings. The inhabitants claim to fence the whole neighborhood for security needs.

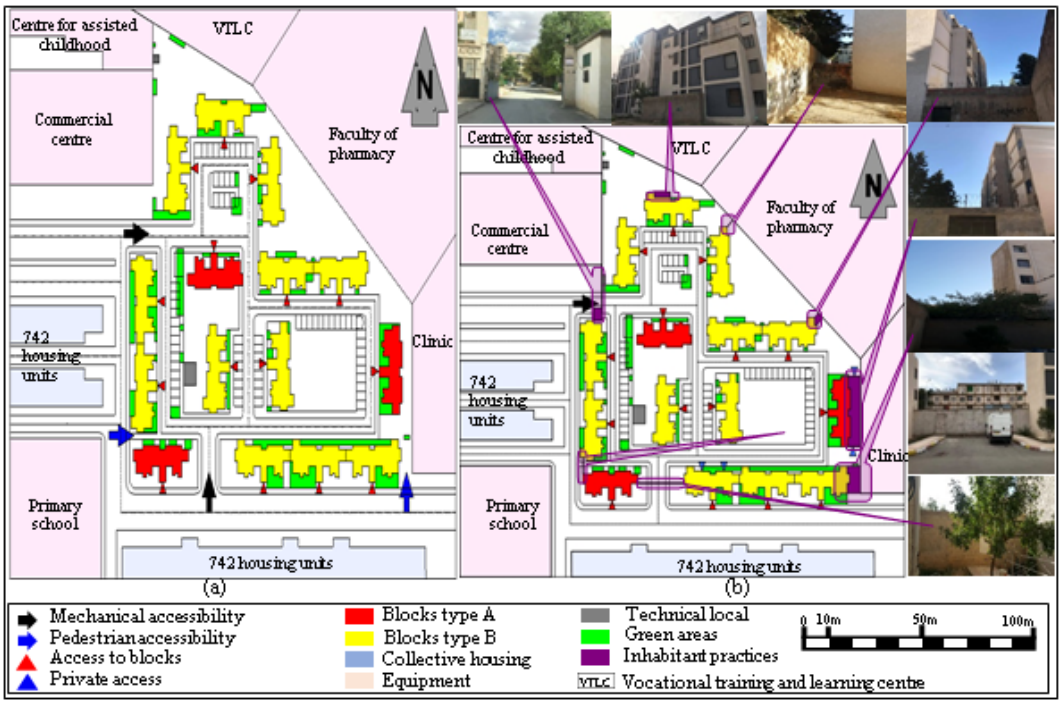
- The creation of access on the west side giving on a secondary road and closing of the access on the south side giving on the main road.

- Creation of a large gate with security guards to control pedestrian and vehicle flows.

- The appropriation of residual outdoor spaces to create gardens and courtyards annexed to the accommodation on the ground floor.

-The creation of parking and play areas in the central spaces between the buildings.

Figure 2:Spatial organization of Cité Bellevue. (a)/ Mass plan before the inhabitant practices on the spatial configurations. (b)/ Mass plan of after the inhabitant practices.



RESULTS AND DISCUSSION

The axial analysis on a macro scale

The axial map is a reference to the activity of human movement in space (18), it is formed of the longest axial lines and the fewest possible ones that may exist in the urban space covering all accessible public spaces. It is represented by a graph where the lines are assimilated to connections and the intersections of lines to nodes. This map makes it possible to read the entire urban system and to model and analyze urban spatial configurations (17).

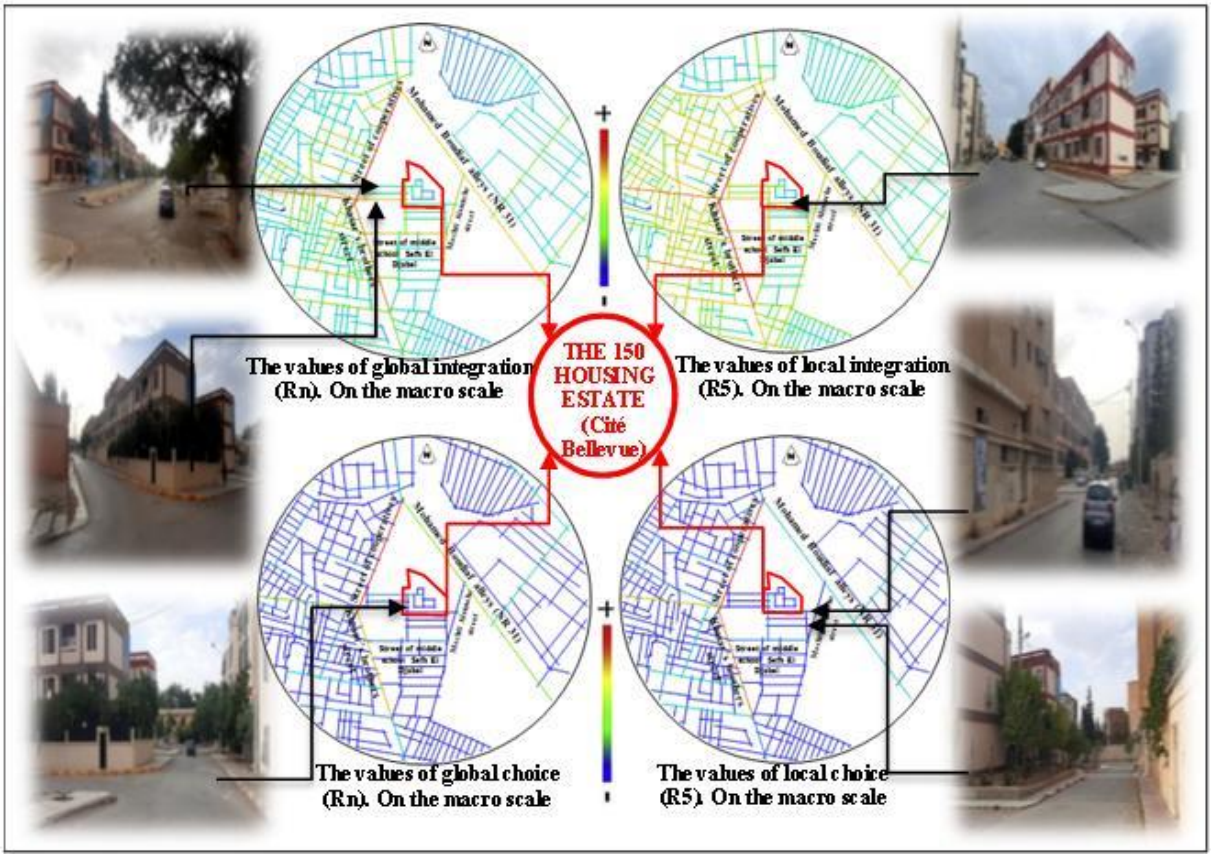
The analysis of the axial map was carried out over a radius of 800 meters, from the city center, as a better measure of representing local movement (22). Among the measurements obtained by axial analysis, we can distinguish:

Global HH and local R5 integration

Global integration is the value of the integration of a spatial element that can be calculated by taking into consideration all the lines of the system with n radius (Rn) (32). But it is also possible to limit the number oflines during calculations, this is called local integration. The key to the evaluation of the local integration of an urban environment is found in the calculation of the average value of the average depth of all the axes in a system (33). For our case, the value of the average depth is 5,81052, so we will limit ourselves to 5 analysis radii (R5).

Figure 3 shows the results of the axial map analysis at the macro scale for the integration values (Rn, R5) of *Cité Bellevue*. The spatial accessibility of the neighborhood will be analyzed in the hierarchical order of global and local integration values, going from the most integrated nucleus (in red color) to the most segregated (in shades of blue). The axes are classified from the most integrated to the most segregated. The streets of *Grine brothers*, *cooperatives,* and the *Khasar brothers* are considered to be the most integrated axes compared to the others (their values vary between 2 and 2,4) because they are connected to the network that leads to the city center. In addition, the least integrated axes take values from 1,7 to 1,9. These are *Mohamed Boudiaf* alleys which are connected to the neighborhood ring road which is an avoidance axis, as well as *Mechti Alouache* street and *Sefh El Djabel* College street, as axes serving residential areas.

Figure 3: The axial map results on the macro scale (800 m) for integration (Rn, R5), choice (Rn, R5) values of Cité Bellevue.



The global and local choice

"The choice is a measure that reflects the total distance of an axial line from other axial lines or the number of shortest paths that connect an axial line to other axial lines" (34, p.04). The advantage of measuring the overall choice (Rn) would be to be able to assess the possible choices of pedestrian routes. The maximum values of the global choice (35.971) and of the local choice (R5) (10.001) are found at the level of the street of the cooperatives which turns out to be the most integrated axis, as well as, the entrance to the

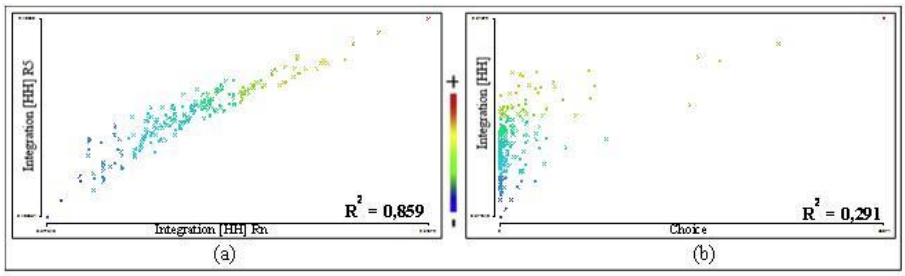
neighborhood and the axes which lead there with a value of global choice (3.690) and local choice (717). The axes inside the district indicate very low values varying between 0 and 149 at the local level and the global level between 0 and 1.535. These lanes are intended for internal movement and for parking cars which decreases the probability that they are chosen as the travel route.

Synergy / interface

To support the result concerning the function and the degree of attractiveness of the district, it was necessary to proceed to the measurement of the degree of its stability and its vitality through the synergy measurement which is the correlation between the local and global natural dynamics, it is the coherent relationship between local and global movement patterns that allow rational behavior in the choice of location for land use (35). The scatterplot (Figure 4(a)) of the local area effect shows a correlation coefficient R2 of 0,86 which indicates a strong correlation and a more consistent relationship between local areas and the overall system, meaning that the district is lively and stable.

To test the degree of accessibility, we used the interface measure, which is the correlation between integration and choice (36). The interface diagram in figure 4(b) suggests a diffuse dispersion and shows a relatively low regression coefficient R2=0,29, which is consistent with the difficulty of access within the district, explained by the fact that it is surrounded by educational facilities and a residential area.

Figure 4:The axial map results on the macro scale (800 m) for synergy and interface values of Cité Bellevue. (a)/Synergy; (b)/interface.



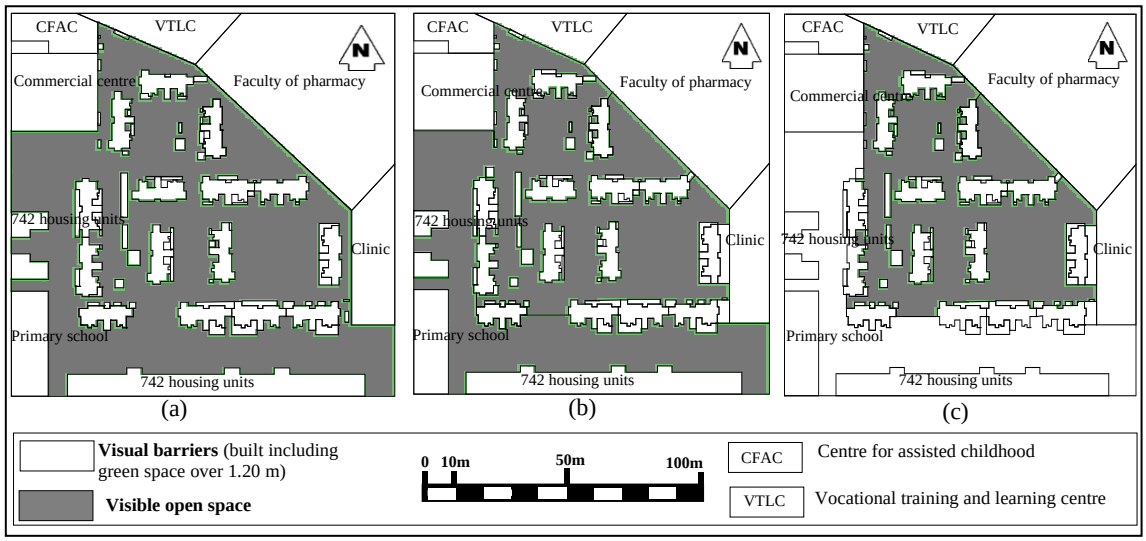
Analysis of the visibility and visual accessibility of the city at the microscale

This is a comparative study of the district of 150 housing units (*Cité Bellevue*) before and after enclosure (closed door and open door) through the syntactic analysis of visibility (VGA analysis) and accessibility (ALA analysis). These analyzes can inform and quantify the permeability of the space studied and qualify its ability to orient people and assess its visibility according to the different configurations of this same space.

The district will be modeled by the technique of space syntax based on the properties of visibility and visual obstacles (more than 1,20 meters in height have been taken into consideration) (37) where most of these obstacles are

informal green spaces appropriated by the inhabitants near the dwellings. The analysis of accessibility and visibility will be carried out in the district before the enclosure. System after enclosure with the opendoor and with the door closed. The proposed analysis will be limited only to the boundary of the district as well as to its immediate surroundings (figure 5).

Figure 5:The initial visibility model of Cité Bellevue before and after the enclosure and taking visual barriers higher than 1,20 meters into account. (a): initial state before enclosure, (b): after enclosure open door, and (c): complete enclosure.



Analysis of visibility graphs (VGA)

The analysis of visibility graphs (VGA) helps to understand the relationship between the visibility of space and its use by inhabitants. The syntactic measures that are taken in the analysis are:

HH visual integration / visual connectivity

Visual integration HH is developed by Hillier and Hanson, it is a static measure that describes the average depth of space relative to all other spaces in the system; indicating the extent to which a space is integrated or segregated from the system (38) and gives the relationship between the visibility of any cell in the grid(of about 800 mm for good resolution) in space and that of other cells. The visual integration results show that:

- Before the enclosure: the maximum values represented by the color red (between 13 and 15,55) should be noted at the level of the access road (south side) to the district which shows a strong integration with its immediate environment. As well as the majority of the spaces are integrated (with average values of more than 9 and represented by the color light orange) and are found in the center and west of the neighborhood. On the other hand, the interstitial spaces behind apartment buildings are found with minimum values indicated by the

color light blue (between 8 and 3,58). These values attest to the integration of the neighborhood into its environment (figure 6(a)).

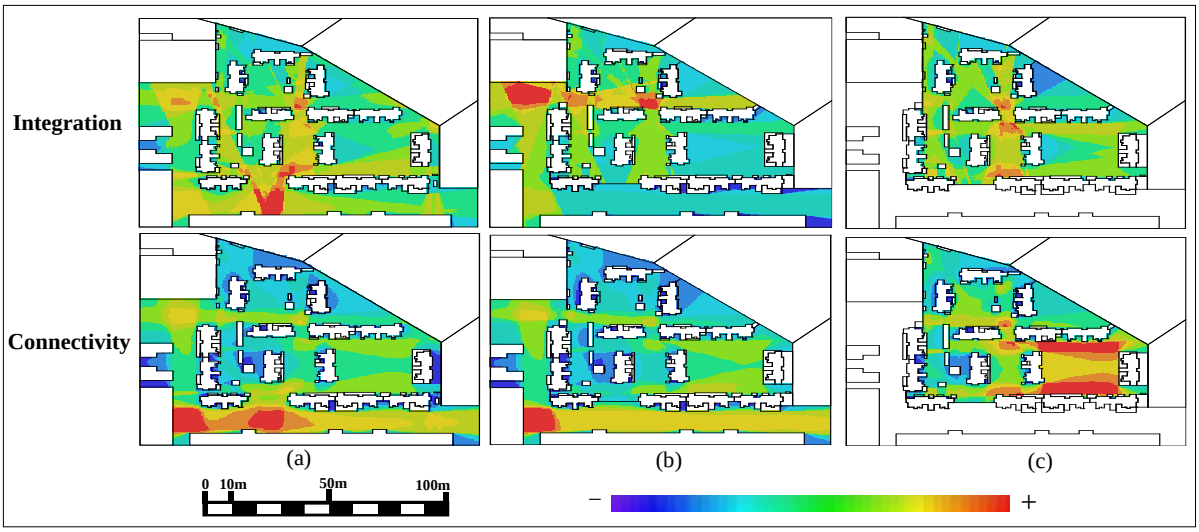
- After closing while keeping the gate open: there is only one limited field of vision and the integrated zones have changed accordingly. In addition, the most integrated spaces are located near the access and along the line of visibility on the nodes of intersections of the lanes between the buildings and display maximum values (between 10 and 11,53). Furthermore, the spaces located between the buildings and which have a visual relationship with the most integrated axis display average values, ranging from 5 to 7. The other spaces far from this axis show segregation in the system with a minimum value equal to 3,32 especially the spaces behind the blocks (figure 6(b)). The further away from the access the more the neighborhood becomes segregated. This segregated part has been converted by the inhabitants into a parking lot and a play area for children.

- Once closed, the visibility and permeability of the district were affected, reinforcing its segregation from its immediate environment. The results of the analysis show minimum values of 5,00 for the least integrated spaces and maximum values ranging from 12,00 to 16,32 for the most integrated spaces (figure 6(c)). These values testify to the balanced integration of the various blocks of the district, particularly in the center and at the level of the spaces between the blocks. Only a few spaces are in an isolated situation, but their effect remains very local and has no effect on the overall integration of the neighborhood.

Visual connectivity

Visual connectivity analysis helps identify spaces with the most connectivity, that is to say, those which are directly or indirectly linked by visual depth to the whole of the neighborhood. Before closing, the district is very well connected to its environment with a rate of 9.555 connections, especially on the south side which is open to the city and from which one can access the district, this rate decreases when one penetrates deep inside the district to reach the 2.000 connections (figure 6(a)). After the enclosure, open gate, the district is connected through a single point that links it to the main road to the south with 9.306 connections and to a lesser extent to its entrance. In addition, less-connected spaces with very low values (less than 2.000 connections) correspond to the surroundings of apartment buildings (figure 6(b)). Once the door is closed, the district seems completely disconnected from its environment, on the other hand, we observe an increase in its connectivity, especially in the spaces which are in the center and the South-East and which correspond to the large side parking lot, with a high connectivity value of more than 5.000connections (figure 6(c)). This confirms the wise choice of the inhabitants as to the location of the car park and the play space in order of its isolation from the immediate surroundings of the neighborhood and its better connection to the local level after enclosure.

Figure 6: Results for visual integration and connectivity values of Cité Bellevue. (a): initial state before enclosure, (b): after enclosure open door, and (c): complete enclosure.



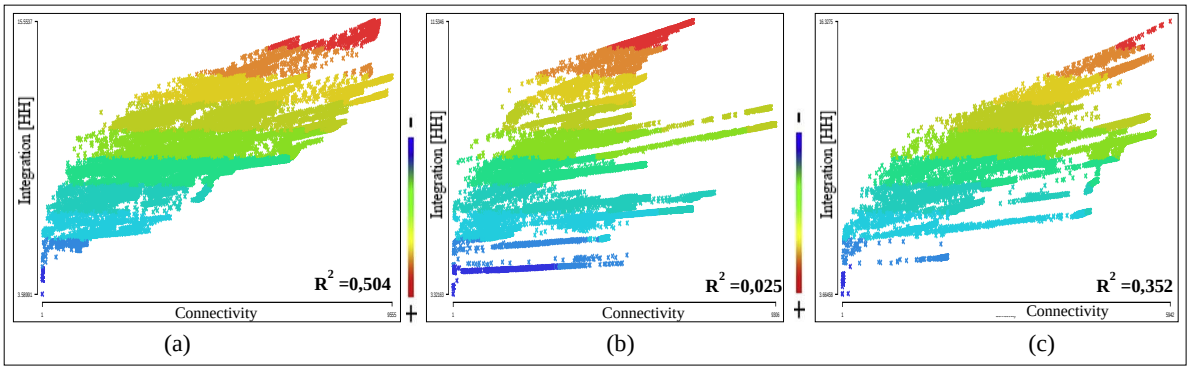
Visual intelligibility

From the two previous measurements, comes intelligibility which represents the correlation between the local measure of connectivity, and the global measure of integration which describes how deep space is, about the whole system, can be deduced from the number of direct connections. It designates the capacity that a structure may have to give reports at the local level on the structuring role of spaces at the global level (39). According to the coefficient of this correlation (R2), we say that the system is intelligible if R2>0,5, this means that all the spaces of this system that are well connected also tend to be well integrated. On the other hand; if R2<0,5 the system is unintelligible (24). The graphs in Figure 7 show:

- Before the enclosure, the system has acceptable intelligibility with a regression coefficient of R2=0,50 which proves that it is moderately connected at the local level and well-integrated at the global level, and easily navigable (figure 7(a)).

- After enclosure with the open door, the integration graph displays values significantly lower than those of connectivity, the correlation of which reveals a scattered point cloud. The coefficient of determination R2 gives a result of 0,02 which is a very weak correlation and therefore expresses the non-intelligibility of the system, which means that we cannot deduce the global scale from the scale local (figure 7(b)). If the door is kept closed, the correlation coefficient R2 gains a point to be 0,35, but the system is still unintelligible, which indicates poor readability of space through the relationship between integration and connectivity. Thus, the visual system is not open enough and does not offer wide visual fields at the local level, hence the gap between the local and global scale (Figure 7(c)).

Figure 7: Results for visual intelligibility values. (a): initial state before enclosure, (b): after enclosure open door, and (c): complete enclosure.



The three diagrams show that the district is moderately connected to its immediate environment because the facilities that surround it on the north and east sides obstruct its visibility even before the inhabitants have closed it, therefore its enclosure has accentuated its isolation.

The inhabitants, by fencing their neighborhood wanted to control access to ensure more security; this aspect was subjected to syntactic analysis, the results of which are obtained from control and controllability measures.

Visual control and controllability

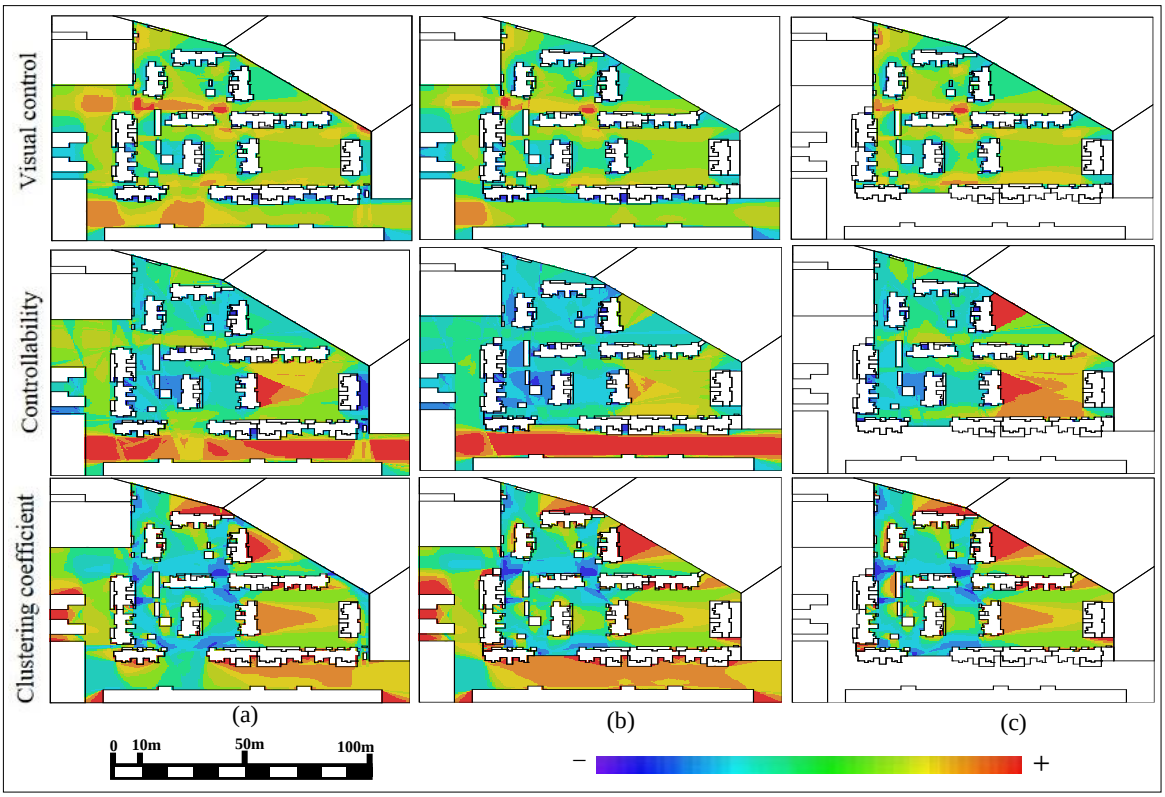
Visual control involves the visual selection of dominant areas (34), the control indicator as local property measures the degree of control of a specific space taking into account neighboring spaces (40), whereas controllability determines which spaces can be dominated visually and determines which areas are easily monitored during a walk (28).

The results of the syntactic analysis of these two parameters show that the control in the district when it was open was multiple and diffuse with a value of 0,99 and takes place on the different accesses given to the interior by displaying the highest control values (between 0,9 and 1,7), this multiplicity will be ineffective. The best-guarded areas, with average controllability of 0,24, are the lane south of the neighborhood and the space reserved for parking cars between blocks of buildings. Indeed, these two spaces are visually dominated by the presence of buildings whose façades overlook these spaces with the controllability value varying between 0,33 and 0,43 well above the average figure 8(a).

After closing the neighborhood with open or closed access (figure 8 (b) and (c)), the visual control values improved slightly compared to the first case, and the control points focused on the visual axis of the entrance to the neighborhood which gained a greater control value (1,87) than it had in the absence of the enclosing walls (1,73). The average of the control is almost constant in all three cases but varies according to the areas where it can be noticed that once the door is closed, it is the area reserved for the parking lot that gains control. As for controllability, it is always the south axis that wins out because it is visually linked to the axis that leads to the entrance. Once the neighborhood is enclosed, controllability is accentuated in the spaces

between the building blocks, particularly the parking area and the children's play area.

Figure 8: Results for visual control, controllability, and clustering coefficient values (a): initial state before enclosure, (b): after enclosure open door, and (c): complete enclosure.



The coefficient of compactness

The clustering coefficient (Ci) indicates “how a pedestrian space perception changes in case of moving away from a current location. The loss of visual information due to pedestrian movement reduces the value of the clustering coefficient”(34, p.04), and it indicates whether the majority of spaces are convex or rather axial.

In all three cases, figures 8(a), (b), and(c) show almost the same values for the clustering coefficient. The center of the neighborhood encourages movement and strolling, while the spaces likely to be meeting places are the spaces behind apartment buildings. The convexity is noticeable in these places with high values varying between 0,9 and 1. In addition, the spaces showing high values (varying between 0,8 and 0,9) are located between the two blocks where the parking is located in the center on the east side inside the city on the one hand, and on the other hand, outside the city on the South mechanical route. The inhabitants by closing the district have favored the static nature of these spaces and therefore their controllability and have therefore developed these areas as parking, which promotes their security character.

Analysis according to the "All-line visibility maps analysis" (ALA) technique

The technique of "All line visibility maps" makes it possible to highlight the influence of physical forms and their arrangements on the different possible fields of visible open space, and how they orient human action in this space to study its axial structure concerning the space used by walkers (18,15). This analysis was applied to verify the connectivity and the axial integration and the axial intelligibility of *Cité Bellevue* in the urban system.

Integration

Before enclosure: the graph (figure 9(a)) shows a central axis in the form of a diagonal between the North and the South at high integration values of red color (between 11 and 14,59), which corresponds to the southern access of the city which generates the greatest flow. The average values, vary between 7,6 and 10,9 and are mainly distributed at the level of the outdoor spaces of the western part of the city. Whereas, the eastern part displays low values ranging from 3,3 to 7,6 because it is located behind the traffic axes linked to the accesses.

After enclosure: if the door is open, movement is generated at the level of the only access to the district, but the movement is accentuated in the central part which distributes to the rest of the district. Its importance is also maintained after the complete enclosure of the district (figure 9(b), (c)).

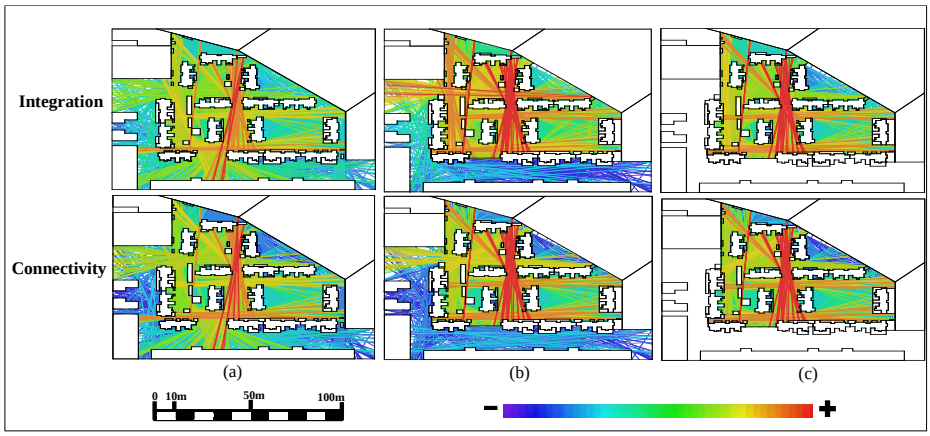
Connectivity

- Before enclosure: the connectivity graph indicates a distribution of values close to the integration graph. The axes take strong values of connectivity between 429 and 1.329 cross in the center of the neighborhood. These axes develop in two directions: some extend transversely toward the west entrance, and the others extend longitudinally toward the south entrance (figure 9(a)).

- After enclosure: connectivity displays its lowest values on the south side, rising as it progresses towards the west entrance which remains the only point of connection with the immediate environment (figure 9(b)).

On the other hand, if the door is closed, (figure 9(c)) there is a very punctual connected structure, located in the center and it does not extend around the district. There is a crossing of axes with high connectivity values inside the neighborhood, but they do not extend from the peripheral roads (West and South). The least connected axes are behind the blocks (northeast side) are segregated with values between 50 and 350, mainly due to their location on the outskirts. What can be noticed and confirmed is the choice of the parking location which does not favor traffic and would be a safe place for car parking and children's play.

Figure 9: Results for integration and connectivity values. (a): initial state before enclosure, (b): after enclosure open door, and (c): complete enclosure.



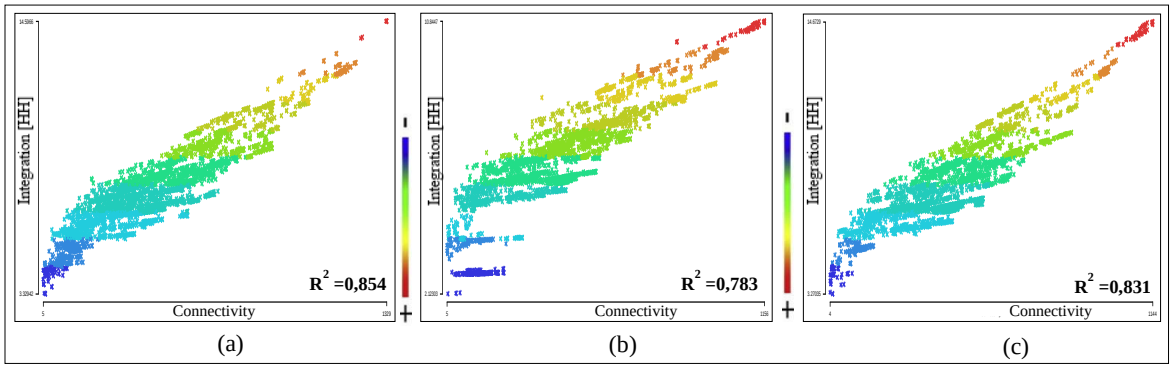
Axial intelligibility

According to Hillier(15), axial intelligibility is an indicator of the quality of an environment as being easily navigable. He notes that the degree of intelligibility can be predicted by looking at the shape of the dispersion. If the point cloud forms a straight line at a 45 degree angle, this proves that there is a good correlation between local and global integration and explains that the system would be highly intelligible (15, 41).

Figure 10 reveals coefficients of determination quite close to each other (R2=0,85; R2=0,78 and R2=0,83), showing that there is a strong correlation between integration and connectivity. The system is considered highly intelligible in all three cases and therefore provided with good visibility. Well-connected spaces are also well-integrated spaces. Also, accessibility and orientation will not be difficult. Note that the second case shows inferior intelligibility relative to the other cases, while the first remains the best. Visibility and accessibility are best understood in the case of openness. So, we can say that despite the enclosure of outdoor spaces, the neighborhood plays an essential role in its environment.

The results of this analysis contradict the visibility analysis. While the enclosure contributed to the isolation of the neighborhood visually, it had no impact on its accessibility. The system shows good intelligibility in all three cases (figure10).While the enclosure impedes visibility, it makes it easier to orient people through the use of single access and minimizing changes in direction. Navigation choices vary depending on the degree of familiarity with the surroundings; novice users are more likely to follow more direct routes with fewer changes of direction (42).

Figure 10: Results for axial intelligibility values. (a): initial state before enclosure, (b): after enclosure open door, and (c): complete enclosure.



(a) (b) (c)

CONCLUSION

The practice of enclosure is starting to gain momentum in residential estates in Algeria. Closed, private, or landlocked residential complexes are generally spread over small land bases and medium-built densities (43). This trend seems to testify to the growing importance in the ways of inhabiting the processes of securing and socialization. The neighborhood is being made in pieces and more and more private enclaves are sometimes secure. Urban perspective essays show us a fragmented city under the effect of the development of residential self-isolation, reflecting both a search for security and an appropriation of urban space (44).

Four characteristics can define a landlocked morphology whose impact is separation and rupture with the neighboring environment: withdrawal, physical and visual impermeability, exclusionary territoriality, and rewarding isolation (45). These aspects were approached by the space syntax which allowed us to analyze the impact of the enclosure on the visibility and accessibility of a residential district. Axial analysis, VGA (visibility graph analysis), and ALA (all-line analysis) were adopted to assess its integration with the city and the surrounding environment as well as its degree of intelligibility.

The estate of 150 logements (*Cité Bellevue*) is located in a residential area with a morphology that contributed to its isolation even before the inhabitants decided to close it completely. The introverted orientation of the buildings goes in the direction of its isolation and disconnection (at least visually). In addition, the nature of the contiguous spaces contributed to add an effect of segregation, a kind of exogenous enclavement. The pharmacy faculty and the training center are walled equipment of weakly mutable nature, creating a barrier on the north side and therefore a guarantee of remaining isolated in the long term.

In the particular context of our case, the axial map modeling allowed us to read and analyze the urban morphology of the district as a whole as well as its different parts. It made it possible to measure the global and local properties of the neighborhood's urban outdoor public spaces in terms of spatial accessibility. The results were able to show low levels of integration, choice, and interface of the district at the macro scale serve to segregate our

neighborhood from the immediate environment. While the practice of opening and closing contributes to the segregation of a neighborhood or its visual integration with its environment, the all-line analysis has shown that the neighborhood is very well accessible and highly intelligible.

It is accepted that every city has an integrating nucleus which is generally located in the center, the further one moves towards the periphery, the system becomes segregated. The neighborhood after the enclosure is assimilated into a miniature city, knowing their place of residence well, the users of the district have demonstrated a high degree of habitability, the integrated and well-connected central core is reserved for traffic favoring movement and control and facilitating access to different areas of the neighborhood.

The developments inside the district were very well affected by the users. According to its urban morphology, the choice of play spaces, parking areas, and green spaces behind the blocks of buildings were wise.Indeed and according to the clustering coefficient, the play areas and the parking lot are spaces that favor regrouping and the controllability far from the dynamic axes with strong movement. The spaces behind the blocks that escape control have been appropriated by the inhabitants of the ground floor as a protected green space. The control analysis indicated a similarity for the three cases studied showing that the urban morphology of the estate was well designed from the start, it is a secure neighborhood and the fence still reinforced its security but by isolating it from its environment. Also, the choice of the access point of the city was very wise. The VGA analysis showed that the visibility of the western access is better than that of the south despite that it is connected to the main road with strong circulation.

This result does not agree with the results of previous studies by Hillier (15); Turner and Penn (46); Bada and Farhi, (30); Bendjedidi et al., (37), which confirmed that the visibility and the visual field generated by the spatial configuration seem to have a significant impact on use; the more legible and visible the space, the more it is better experienced and more used by the user. But when it comes to a residential area, things change and public space tends to be privatized and no stranger is allowed into it. Indeed, the inhabitants have appropriated this space by delimiting it to keep more privacy and prevent the access of unwanted foreigners, where it has been observed that these spaces will be more controlled, secure, used by having stronger neighborly relations. If the enclosure contributes to the fragmentation of the urban space of the city, it produces neighborhoods that are well suited, protected, and clean and give a positive character of habitability.

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