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Space Syntax as a Tool for Analyzing Permeability in Urban Public Spaces: Case of a Spontaneous Neighborhood

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Abstarct

Like other Algerian cities, Biskra has experienced a much-accelerated evolution through the different periods of its history which has caused negative effects on the quality of urban life. Today, the extensions of the city, especially spontaneous, are faced with problems related to various dysfunctions in urban public spaces. They are assimilated to simple residual spaces between constructions, most often dedicated to roads. These results in conflicts of use, and manners of consuming space that seems to depend on the permeability, legibility, and orientation of the user, thus disorganizing public space and degrading the living environment whose consequences are harmful to the behavior of its occupants.

The objective of the present work is to read and analyze the quality of permeability in urban public spaces and to characterize the influence of the space on the movement of pedestrians and therefore their behavior. The chosen case studies are the urban public spaces in the spontaneous neighborhood of SidiGhezzal in the city of Biskra. This work focuses on highlighting the urban dimension that we consider as a single component dealing with the global and the local and the duality relationship between the built form and the urban public space. The suggested analysis model combines the Responsive Environments' method and space syntax. Its validation is assured by the confrontation of the results of the analysis of the space syntax and the results of the survey by the direct observation technique, "Gate counts". It showed the quality of urbanity, especially the permeability by a correlation between the integration and the graphs of users' movements.

Key words: Accessibility, Axial analysis, Permeability, Space Syntax, Urban Public Space.

INTRODUCTION

From the first years of independence, the Algerian state policy was more oriented towards the economic sector and in particular that of industry. Several hundred hectares of agricultural land were consumed by sites reserved for industrial production units. This has led to problems related to the exodus of populations in search of work. One of these problems is the housing deficit due to population growth, migration, and rural exodus is important. To deal with this urgent need, the state was obliged to revive the housing sector. From the second half of the 1970s, it took charge of almost all housing programs, in the form of large compounds and planned self-built housing estates. At the same time and during the same period, the so-called spontaneous or illicit housing estates have continued to expand, encouraged by the problem of insecurity in the 1990s.

It is a finding, now widely shared, that the Algerian City is sick: urban sprawl, fragmentation, socio-spatial segregation, congestion, insecurity, and considerable upheaval in urban public spaces on the formal and functional plan, in their uses and practices. The urban public spaces in the spontaneous housing neighborhoods of the city of Biskra express a reality of serious difficulties, of malaise: The absence of common places of gathering and meeting and playgrounds, the inexistence of development and urban furniture (signs, public benches, kiosks...). The densification of the neighborhood is often done at the expense of common spaces (green spaces, plazas, etc.). These spontaneous neighborhoods have become true urban neighborhoods, for the new extensions, the city is no longer thought of as a whole or an entity but rather made up of pieces that do not articulate with each other, the notion of urban public space is ignored. These dysfunctions in terms of spatial structuring, permeability, orientation (way finding), and identification... have made accessibility difficult in these urban public spaces. These neighborhoods are deprived of urbanity and security, and we

find ourselves with anti-social and aggressive behaviors. In this regard, we pose a problem that highlights the urban dimension that we consider as a single component dealing with both the whole "the global" and the entities "the local" in the urban grid.

The urban public space has always played a central and structuring role in the construction of the city and architectural and urbanistic thought, but each era or each tendency has made it play a different role in the design process. The use of this notion of public space goes back to the end of the 1970s when the term urbanity took shape in the return to the city and the awareness of the quality and fragility of the urban environment. Urban public spaces (the street, the alley, the square, the avenue, the plaza, etc.) are important elements of our daily life. The quality urban design creates areas where people want to live, work and invest. The term public space refers to spaces that are accessible to all (Zimmermann, 2001). Accessibility does not necessarily require the development of efficient transport infrastructure to increase mobility; it can be promoted by the proximity of different activities. It should make it possible to stitch together a fragmented urban fabric, bring together heterogeneous spaces, and to re-establish certain continuity in the urban structure (Germain, 2002). It is the place where people meet and mix, where users have both margins of freedom and collectively accepted forms of control. Also, a place where the urbanity of the city is supposed to take shape: the space of the common, where we agree to share and live together. (Humbert, 2018) The dimensions of urban public space contributing to urban design have both tangible and intangible attributes, with qualities of urbanity. One of these necessary attributes is permeability.

CONCEPT OF PERMEABILITY

Permeability has an important influence on the proper use of space. It is the degree to which a place is accessible to people (where people can or cannot go) (Bentley, 1985). This component expresses the capacity of the space to allow easy accessibility by its users. It is entailed by the number of real connections between all the places that constitute the urban whole (Jiménez, 2006). (Figure 1) and (Figure 2). Also, it has fundamental implications for the layout. It must be considered early in the design process.

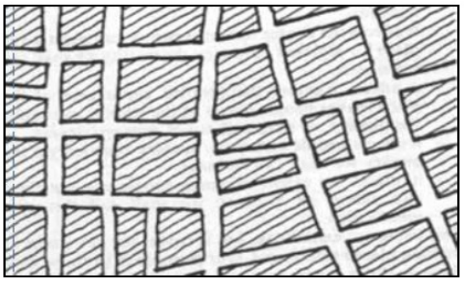

Figure 1. Large choice of itineraries: more permeable. Source : Bentley (1985)

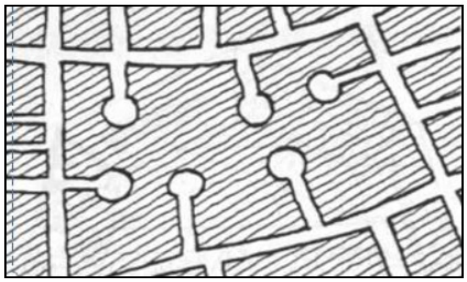

Figure 2. Less choice of itineraries: less permeable. Source : Bentley (1985)

The permeability of any system of urban public space depends on the number of alternative routes it is offered from one point to another. These alternative routes are visible to users who already know the urban space. Visual permeability is important, for example even if a path exists in some environments if it is not visually obvious it remains unused. (Bentley, 1985) Both physical and visual permeability depend on how the public space network divides the environment into blocks. Routes vary in size and shape. Smaller blocks give the advantage of more physical permeability; they increase visual permeability, which helps the user to be aware of his choice. The smaller the block the easier it is to see into another nearby junction along the direction (Bentley, 1985), this implies a good permeability (Figure 3).

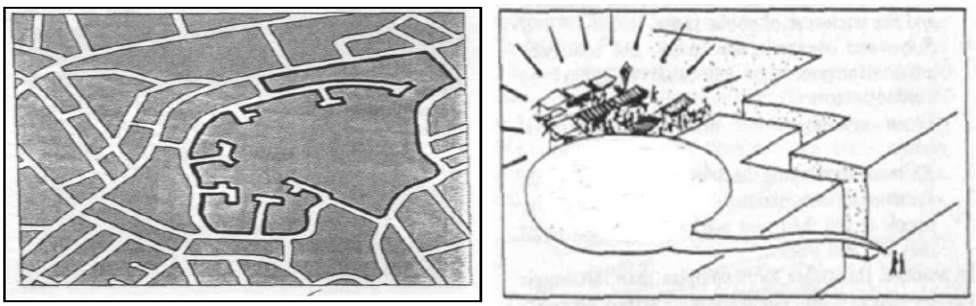

Figure 3. Physical permeability and visual permeability. Source : Bentley (1985)

Small blocks are often advocated for reasons such as urban vitality, permeability, visual interest, and legibility (Carmona, 2003). Jane Jacobs (1961) emphasized the need for small blocks due to increased urban vitality and the role of urban public spaces in creating social interactions (Kashanijou, and al. 2012).. Similarly, Leon Krier (1996) also prefers small blocks for their urbanity. Also, the shape of the grid characterized by regularity or irregularity does not influence physical permeability but deformations can affect movement by reducing the visual potential of permeability. (Bentley, 1985). Deformed grids generally have a picturesque character as a result of their spatial enclosure; regular grids have often been criticized for their monotony (Sitte, 1980). Movement depends on the configuration of the urban public space. It is mainly determined by the spatial configuration, and the structure of the urban frame, which is the most powerful determinant of urban movement (Hillier, 2007).

METHOD AND MATERIALS

In the field of urban space research, approaches with methods, techniques, and analysis tools that focus on urban design, the process of making better-integrated spaces for users, the design and structure of urban space, the urban design Responsive Environments method and that of space syntax that researchers have often used for modeling.

Responsive Environment

This method is an answer to the question, why modern architecture and urban design are so often criticized as inhuman and repressive, modern architecture, which has practically cut off all connection with the social? It comes in the form of seven concepts translating urban qualities that every open public space is supposed to possess (Figure 4). It is a design process that goes from the most general to the most particular, starting with permeability, variety, legibility, robustness, visual convenience, richness, and personalization (Bentley, 1985). They are developed in different stages that follow each other, in analyzing urban environments and allow to better understanding a place and its different actions. Bentley's manual for designers presents an urban design approach since it takes into consideration urban structure, permeability, legibility, orientation (way finding), etc. This method of analysis is based on the perception by man of his immediate environment.

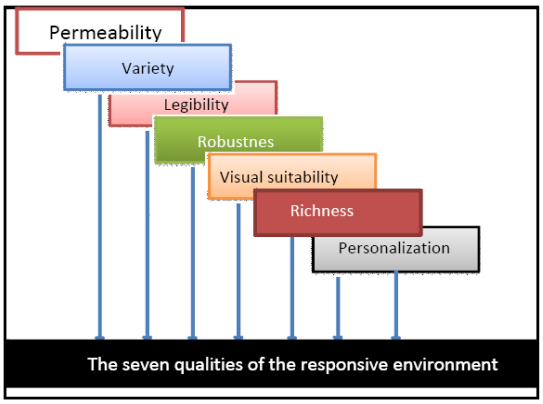

Figure 4. The qualities of urbanity in urban public spaces. Source : Mazouz (2011)

Space Syntax

Space syntax is a structural theory of urban and built spaces. It was introduced by Hillier and his team at UCL in the early 1980s. It is interested in quantifying space from variables derived from graph theory and looking for one or more relationships between structure and functions. (Claramunt, 2005). It is a morphological approach within the framework of urban research. It distinguishes the urban object, the space, and the built form, it isolates the space to study the intrinsic relations and determine the extrinsic relations regarding movements and displacements. It includes both the local and the global dimension in the linked urban grid; the global is not only an assembly of local parts through hierarchical repetition but a structure that creates these parts (Hillier, 1987) and (Hillier and Vaughan, 2007).

It is built based on research on urban transformations employing a set of methods and analytical modeling techniques (configurational axial, convex...) with the ability to objectively measure the physical attributes of cities including those of urban spaces concerning different patterns of human activity, citing as important and essential spatial measures: connectivity, choice and global and local integration (Mazouz, 2009). It is a set of tools developed to describe, explain and interpret spatial social phenomena, summarizing the functioning and dysfunction of urban public spaces such as

movement, displacements, crime, sense of insecurity, etc. (Hillier and Hanson, 1984).Space syntax develops a whole set of techniques of representations that are significant to behaviors. The technique of axiality which is based on a linear definition of space, it is more appropriate for movement.

The Axial Map

The analysis of the urban space is based on the concept of the axial line, which is a line of maximum visibility that connects spaces and stops as soon as the direction changes (Figure 5).

The axial map will consist of the longest and least straight lines that pass through all convex spaces and make all axial connections. It allows for modeling and analyzing the urban configurations of cities, predicting the movement, and location of various activities (Femmam, N., and Mazouz, S., 2018).

Due to the complexity of the calculations, the determination of the axial map is handled by the computer which calculates and gives values such as connectivity and integration (Mazouz, 2013).

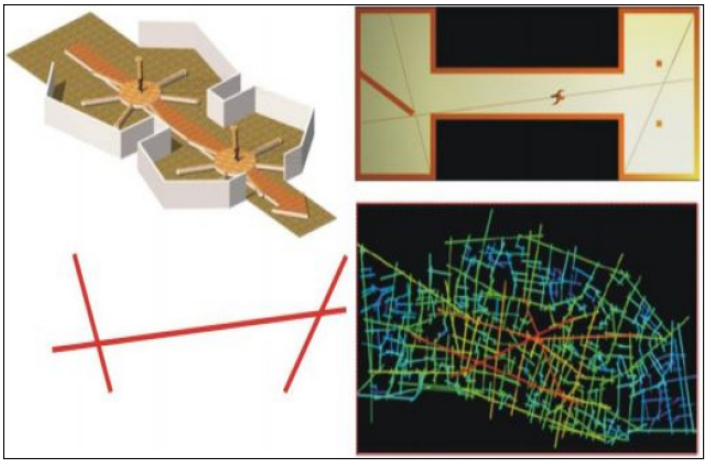

Figure 5. The axial line and its genesis in urban space (from the axial line to the axial map). Source : Mazouz (2013)

T*he All-line analysis*

The All-line analysis technique is based on axiality. It is an automatically generated axial map. It proceeds by generating a multitude of lines, using the computer tool, through the plane of a given spatial arrangement. The principle is that these lines are as numerous and dense as possible, that they extend in all directions, that they do not cross physical obstacles, that they are of arbitrary length, and that they must connect two ends. This technique expresses how physical forms eliminate possibilities for human action in space and redirect them into the available open space. The resulting line patterns are used to calculate configurational values of the resulting spatial structure (Hillier, 2007).

The concept of configuration allows for two scales of reading spatial relationships. The global scale, which concerns the entire spatial structure, describes and specifies the position of each component in the entire system, and the local scale, which describes the position of each spatial element concerning its immediate environment. It concerns local substructures (Femmam, N., and Mazouz, S., 2018).

Some Necessary and Important Measures

The Integration

It is a static global measure. It is related to depth, describing the average depth of space relative to all other spaces in the system. It expresses the capacity of the space to be integrated with the whole or the opposite. It is considered the most important space syntax measure and a primary indicator of movement in cities (Hillier, 2007). Lane integration is defined as the shortest path topologically, in other words, requiring the minimum number of changes in direction between each node (or space) and all other nodes (or spaces) in the urban spatial system. That is, from a topological point of view, the more integrated a space is, the smaller its topological distance from any other space in the system. The majority of studies have demonstrated a strong correlation between integration and the qualities of attendance, location of socio-economic activities, liveliness, and urbanity. (Mazouz, 2013) (Giannopoulou, 2016) and (Yamu and Akkelies, Van Nes, 2017)

Connectivity

It is a static local measure. It expresses the number of connected elements of space with the other nearby spaces. It measures, in an axial map, the number of lines immediately connected to the line under analysis (at a depth step). One depth step means a direct accessibility relationship between two spaces. (Mazouz, 2013)

Intelligibility

It is calculated by the ratio between the integration and connectivity measurements. This measurement ratio is presented in the form of a statistical regression coefficient (R^2). The closer the value of the coefficient is to 1, the stronger the correlation and the points tend to be organized around the 45-degree line. The system is then considered to be intelligible. Each space with both a strong connectivity at the local level and a strong integration value is intelligible. The whole system becomes legible from its constituent parts. If R^2 value is weak then the system is said to be unintelligible. The well-connected space is, however, poorly integrated and the global scale cannot be deduced from the local scale. (Jiang and Claramunt, 2002).

Synergy

It is defined as the correlation between the value of the local integration (radius 3) and the value of the global integration (radius n). It measures the degree to which the local structure of a space is related to the larger scale system in which it is integrated. This relationship is presented in a diagram and is explained by the calculated R^2 coefficient (Dalton, 2003). Studies have shown that synergy is a characteristic that best reflects the vitality and stability of urban functions and inhabitants in neighborhoods.

ANALYSIS MODEL

The suggested analysis model aims at reading and analyzing urban public spaces in terms of urbanity (functioning) with quality measures (permeability). It is based on the combination of two analysis methods: Responsive Environments, space syntax and a survey method. The latter consists of direct observation (Gates counts) allowing the collection of real data that will be used to compare with the results of the simulation (Figure 6). Bentley's permeability is translated by Hillier's accessibility. The latter is considered a tangible quality of urban public space. It is essentially modeled by the integration of order n (global) and order n 3 (local). The indicators of space in the first degree: are connectivity and choice and in the second degree: intelligibility and synergy. This analysis model allows quantifying the qualities of the space to express its functioning and its use, to understand the reasons for the users' displacements and their behavior in these spaces.

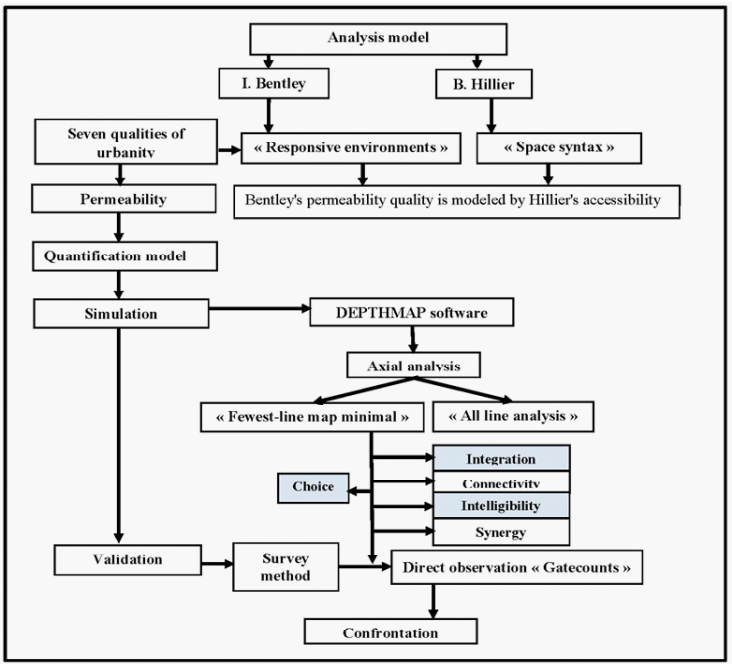

Figure 6. Flow chart presenting the analysis model. Source: Author

Presentation of the case of study

The city of Biskra is located in southeastern Algeria (Figure 7), the neighborhood of SidiGhezzal, our case study, is located southwest of the city of Biskra (Figure 8). Its peripheral position with the city and its spontaneous settlement pattern give it a marginal character. It does not fit into the existing urban fabric. It is served by two national roads, the RN n°46, and the RN n°03. The latter facilitates access to the neighborhood since it is directly linked to Zaatcha Boulevard to reach the city center.

Figure 7. Situation of the city of Biskra. Source: Atlas Mondial Encarta (2005)

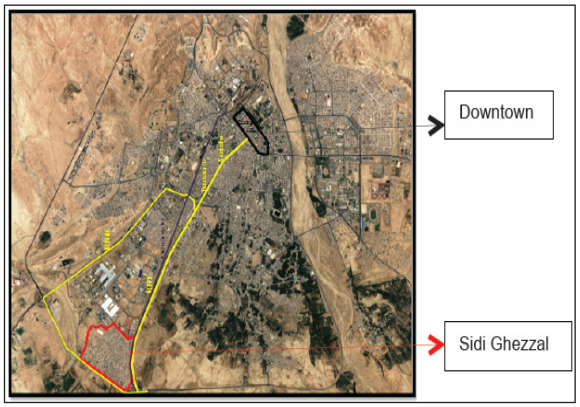

Figure 8. Situation plan of the Sidi Ghezzal neighborhood

This neighborhood occupies an irregularly shaped parcel (Figure 9). The current state of the buildings shows at first sight a large unfinished site. It is the type of unplanned self-built habitat, which does not respond to any norm of the urban regulation. The outer space becomes a residual space of the built form despite the continuity of the streets and the alignment of the buildings (Figure 10) and (Figure 11). The lack of urban public spaces such as places of recreation and gathering, playgrounds for children (Figure 12), (Figure 13), the absence of urban amenities (vegetation, green spaces, car parks ... etc.), and the non-existence of urban furniture (signage, public benches, lighting, kiosks ... etc.) have made accessibility and location difficult. There is also an unequal functioning in these spaces, the presence of places frequented and used by people compared to other places (Figure 14) and (Figure 15). Sometimes the inhabitants use the sidewalks as gathering spaces to chat and thus become obstacles for pedestrians, these groupings can generate acts of insecurity and anti-social behavior. These spaces are devoid of urbanity and safety.

In addition to these physical and urban dysfunctions, others are functional, such as the lack of facilities and services and the lack of variety of activities (Figure 16), which limit the choices of residents and strangers and make the spaces less dynamic. This harms the daily lives of inhabitants and makes the whole neighborhood segregated.

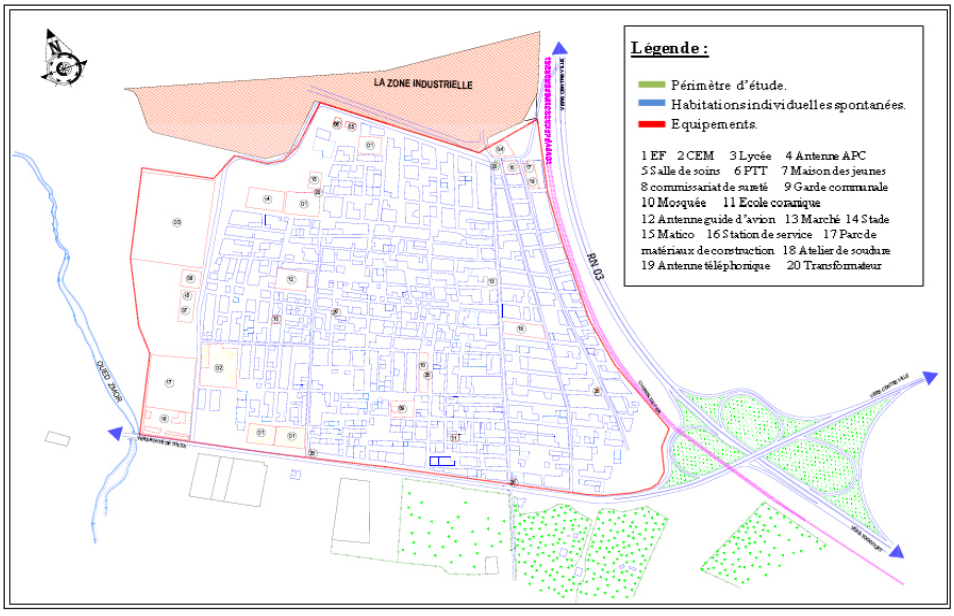

Figure 9. Map of land uses in SidiGhezzal. Source: Author

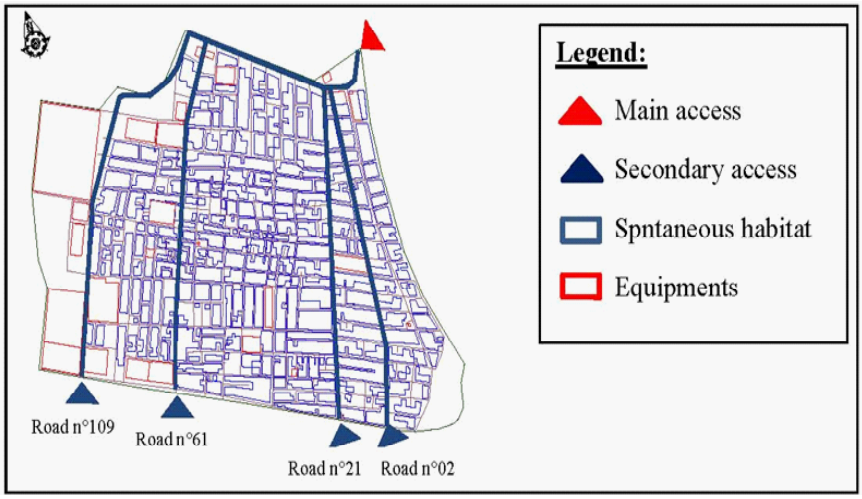

Figure 10. Important axes of the neighborhood. Source : Author

Figure 11. View of the access to the neighborhood. Source : Author

Figure 12. Bus and cab stops in unfavorable conditions. Source : Author

Figure 13. Absence of gathering and meeting places, play areas and urban furniture (signs, vegetation, etc.). Source : Author

Figure 14. Street n° 21 the only street considered relatively dynamic. Source : Author

Figure 15. Deserted street total absence of commercial and service activities. Source : Author

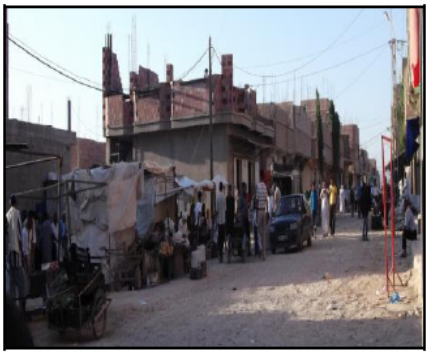

Figure 16. The market space is an appropriation of a private space. Source: Author

RESULTS AND DISCUSSION

Results of The All-Line Analysis

First Degree Measures

The graph (Figure 17) shows the highest values for the main street, which corresponds to axis n°21 and extends from the northern access to the peripheral axis in the south with the color red, followed by axis n°61 and the axis perpendicular to these last two, which leads to the middle and high school in the west of the neighborhood.

The eastern part of the neighborhood is more permeable than the western one. Its regular fabric, close to the orthogonal, contributes to this permeability. The spaces that are the least connected are on the periphery, the access to the main entrance of the neighborhood, and between the constructions inside the neighborhood by the presence of the blue color. The interpretation is considered by the limited number of axes that connect it with the system.

Figure 17. Results of the all-line analysis for the connectivity measure. Source : Author

As for the integration map, it tells us about the most integrated axes, with the red color, a linear integrated structure (Figure 18) along three axes that are actually important axes: street n°21 represents the highest integration values, followed by the streets connected with this main street. Spaces with low integration break away from the axis of high integration to the west and east. Other spaces are segregated from the system by taking on the color blue, particularly the spaces on the periphery to the east, the southeast corner, the northwest corner, the space at the main entrance to the neighborhood, and between the constructions inside the neighborhood. Street n°21 has a high level of frequentation of the urban public space where all the social and commercial activities of the neighborhood take place.

Figure 18. Results of the all-line analysis for the global integration measure. Source : Author

The measure of local integration shows the presence of secondary centralities to the central part that extends to the surroundings of the neighborhood, especially to the southwestern periphery and to the east. Thus, constructions are connected by a continuous structure to the structuring spaces of the neighborhood; therefore public spaces with previously misconceived forms, directed by spontaneous need are residual spaces that show continuity in the global structure (Figure 19).

Figure 19. Results of the all-line analysisfor the measurement of local integration.Source : Author

Second Degree Measure

Intelligibility and Synergy

The graph of intelligibility shows a very strong correlation between integration and connectivity. The system is considered highly intelligible. Its spatial structure is highly intelligible because what we see informs us correctly about what we do not see. Well-connected spaces are also well-integrated spaces. Accessibility and orientation are easy. There is good permeability (Figure 20).

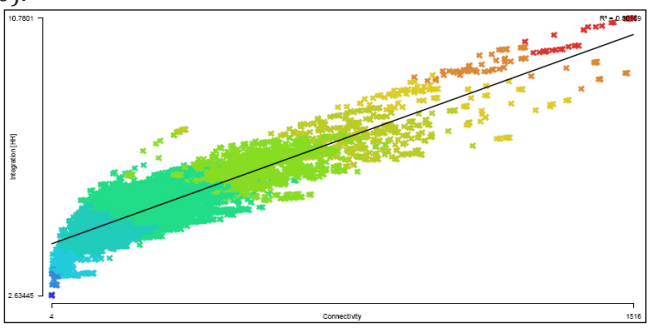

Figure 20. Graph of intelligibility by all line analysis (R^2=0.80). Source: Author

The graph below (Figure 21) shows a strong correlation between local and global integration. The local structure of the space is related to the system in which it is integrated. The axes and structuring spaces show a strong local integration in this neighborhood. They constitute the place shared by both the local and global movements. They are frequented by both strangers and local inhabitants.

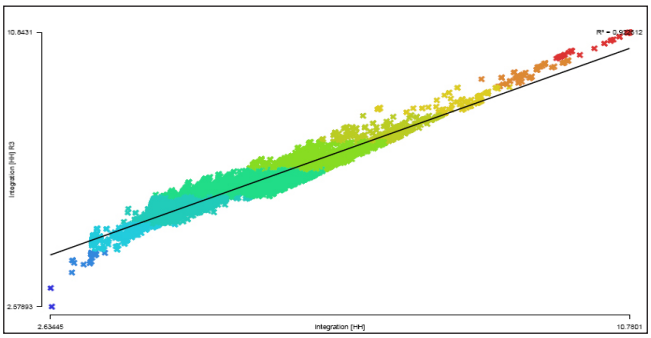

Figure 21. Synergy graph by all line analysis (R^2=0.92).Source: Author

Axial Map Analysis Results

First Degree Measures

The axial analysis for the connectivity measure shows that the highest values are on street n°21. The spaces that are least connected are found across the whole system (Figure 22).

Figure 22. Results of the axial analysis for connectivity measurement. Source : Author

The analysis of the global integration for a radius Rn shows that there is an integrated road system represented by three axes, of which street n°21 is the most integrated (red color), which is the most dynamic and frequented structuring axis of the neighborhood, followed by two other axes that also have important integration values, leaving the other parts of the system in segregation (blue color). The most integrated axes appear to be more easily accessible, permeable and visible than the segregated axes. They are likely to be chosen. The integration values decrease progressively to the most segregated axes (minimum values), those found at the peripheral corners to the southeast, northwest, the access to the main entrance of the neighborhood, and between the houses. The integrated road network of the system is not connected to the integrated road network of the city (Figure 23).

Figure 23. Results of the axial analysis for the global integration measure. Source : Author

Comparing the measure of integration for a radius of R3 with that of Rn, the spaces have very high values of integration and present secondary centralities (presence of activities) (Figure 24), street n°02 to the east of the neighborhood, the tertiary axis perpendicular to the axis the most integrated. These are drivable roads frequented by users, particularly street n°21, which is considered commercial and street n°02, which has a bus stop and cabs.

Other spaces are more integrated locally than globally; leaving the other parts of the system segregated at the peripheral corners, southeast, north-west, the access to the main entrance of the neighborhood, and between the houses. This spatial structure does not offer any potential for movement, especially for visitors. These spaces are more integrated into their local than their global environment, and residents know their neighborhood very well.

Figure 24. Results of the axial analysis for the measurement of local integration. Source : Author

The Measure of Choice

It is a dynamic global measure, telling us the degree to which a space is chosen to be traveled. It seems to reflect the journeys of people with specific knowledge of the studied urban spaces, especially their residents.

The graph shows two axes with very high values of choice and another with important values of choice relative to the whole (Figure 25). The values gradually decrease in habitable spaces. This may promote «through-movement» and facilitate location and orientation.

Figure 25. Results of the axial analysis for the measure of choice. Source: Author

Second Degree Measures

Intelligibility and Synergy

The intelligibility graph shows a fairly strong correlation between global integration and connectivity (Figure 26). This is a highly intelligible system. Locally well-connected spaces are also well-integrated spaces in the whole system (at the global scale). It is very adequate for movement. It is a system in which orientation and accessibility are easy. It tells us that the evolution and extensions of the housing parts of this neighborhood have generated articulated spatial structures despite being a spontaneous neighborhood.

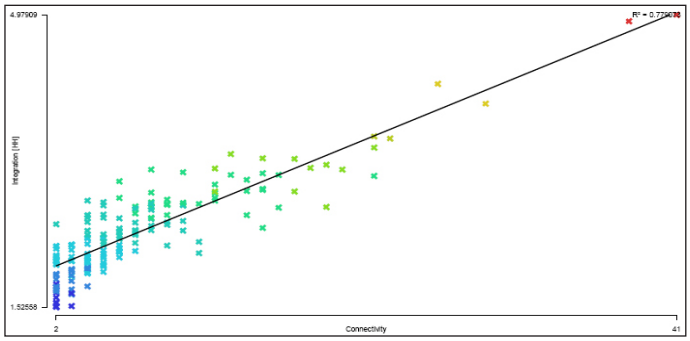

Figure 26. Graph of intelligibility by axial analysis (R^2= 0.77). Source: Author

As for the graph of synergy (Figure 27), a very strong correlation between local and global integration. The local structure of the space is related to the system in which it is integrated. The global and local scales coincide in a common dynamic. The structuring axes of this neighborhood are frequented by both residents and strangers since these axes constitute places shared by both the global and local movements.

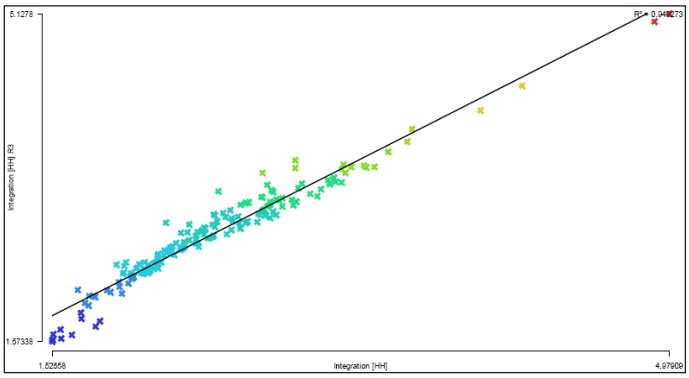

Figure 27. Graph of synergy by the axial analysis, (R^2=0.94). Source: Author

The modeling has allowed us to highlight a spatial structure of the urban public space through the analyses, notably those of the "all line analysis" and the "fewest line _map" which present a correspondence between them.

Through the reading of all the syntactic maps, the maximum values of the syntactic measures are presented in the east of the system, particularly street n°21. The most integrated axis locally and globally, the most connected and with very high values of choice, is the structuring axis of the neighborhood. It is more easily permeable than the other axes of the system, especially the segregated axes on the periphery and between the constructions whose syntactic measures are of minimal values.

Our axial system carries very acceptable syntactic measures for intelligibility and synergy. The most well-connected axes are the well-integrated ones, and those with good integration at the local level are at the same time integrated at the global level. They are easily accessible, oriented, and therefore permeable. Its axes and structuring spaces constitute places shared by both the global and local movements.

FIELD OBSERVATION RESULTS (GATE COUNTS)

The graphs below show the results of the observation using the "Depth map" software. By entering the number of people in movement during the two study days of the survey (Saturday, and Wednesday) these graphs represent inequality in the distribution of user displacement in the urban public spaces of the neighborhood. The movement can be explained through the two notions of "to-movement" and "through-movement".

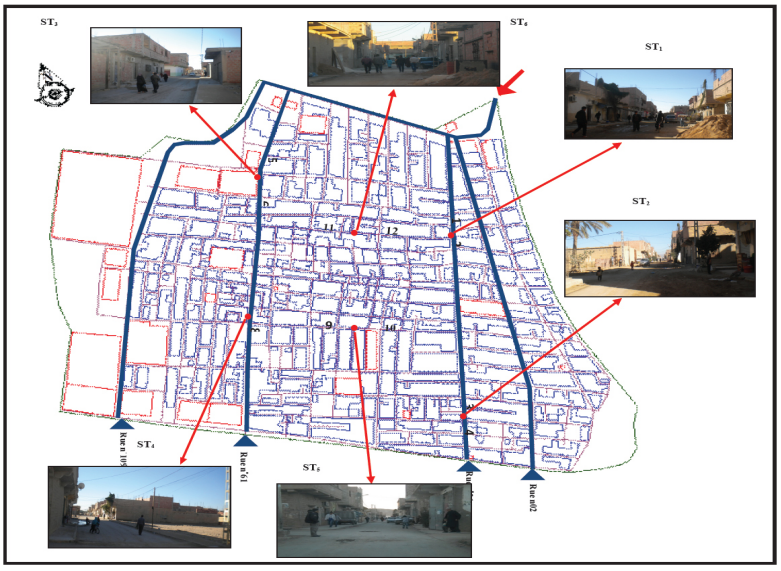

Figure 28. The six stations (ST) chosen in the neighborhood of Sidi Ghezzal for the analysis of the observation during the days of Wednesday and Saturday. Source: Author

Figure 29. Results of the analysis of the observation during the day on Wednesday. Source: Author

According to the graph of the results of the Gate counts analysis (Figure 28), the day of Wednesday (Figure 29) is characterized by a significant displacement of neighborhood inhabitants, which is explained by their movements to the downtown area or vice versa to reach their workplaces outside the neighborhood. All the stations are busier on Saturday (Figure 30) than on other days of the week. Movement logic changes and becomes sensitive to local destinations. Users use the space not as a place of transition but as a place of destination and stay (to-movement) in the majority of the frequented spaces. This is mainly due to the location of the neighborhood, which is on the periphery of the city, to the lack of equipment, even with the existence of a peripheral street to the south intended for commerce and vulcanization, for example, where visitors come to do their shopping, their movement remains outside the neighborhood.

The survey reveals that the movement of pedestrians in the axes of the spontaneous neighborhood of SidiGhezzal indicates a movement pattern of "to-movement". It shows that the space is used mainly as a place to stay and not as a place to pass through. The movement seems to have a local dimension. The urban public space is conceived as one-dimensional.

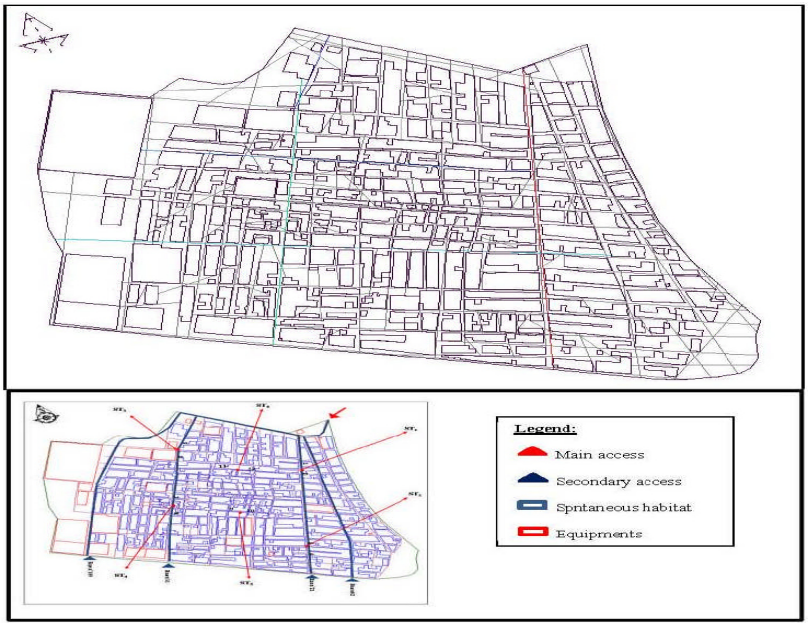

Figure 30. Results of the analysis of the observation during the day on Saturday. Source : Author

CONFRONTATION OF RESULTS

It presents the confrontation between the results of the observation and the axial map which will allow the existence of a correlation between the syntactic measurements with the graphs of movements (Figure 31). Based on this correlation, we will try to verify the relationship of the properties of the space with its functioning.

Figure 31. Results of the integration of the axial map and the number of people moving along the axes of the Sidi Ghezzal neighborhood. Source : Author

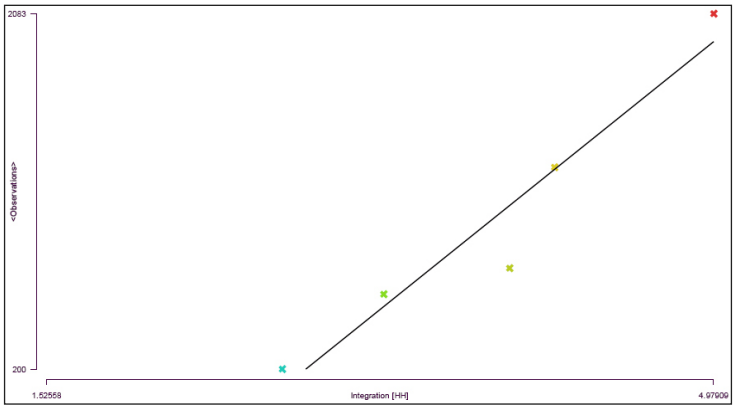

Figure 32. Correlation graph between the number of pedestrian movements (y axis) and the integration (x axis). (R^2 = 0.93). Source: Author

The correlation between integration and frequentation is very strong (Figure 32). The most integrated axes receive the most flow of movement. However, the segregated axes are very weakly walked. In these spaces, anti-social and aggressive behavior is encountered. These behaviors are local. Designers must consider both global and local dimensions, and movement must be both passing and staying.

CONCLUSION

The present study deals with the effect of permeability as the quality of urbanity of urban public spaces on their functioning and use. They show its influence on pedestrian behavior in terms of displacement. They target the dysfunctions in the spaces and then allow to remedy them: the spatial structure, the consideration of both global and local dimensions, to have good quality urban public spaces.

The analysis model for the quantification of this quality allowed bringing out a spatial structure of the urban public space through the axial analysis based on the global and local syntactic values of the first degree: integration, connectivity, and choice. It shows that spatial structure is influenced both locally and globally. It is mainly due to the built form, which in

turn generates forms with ground arrangements of accessible urban public spaces, influenced by local spatial variations. The syntactic values of the second degree, intelligibility, and synergy are strong values, which facilitate accessibility and make spaces more permeable. Axes and structuring spaces are both places shared by both global and local movements. A correlation has been shown between integration (qualities of urbanity, i.e., spatial properties) and frequentation (user displacement). The quality of urban public spaces in terms of permeability affects their functioning.

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