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Fig. 1 Some illustrations showing the different interior spaces of the palace

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Decoding the Spatial Configuration of the Ottoman Palace "Khdewedj El Amia" in Algiers (Algeria) through Space Syntax

architectural heritage
Ottoman palace "Khdewedj El Amia", Algiers, Algeria
spatial integration
space perception
visibility graph analysis

Palaces of the Ottoman era, the Golden age of Islamic civilization, bear witness to a prestigious know-how, drawing its rules from a way of life governed by the Islamic Sharia, the socio-cultural context of the Berber-Arab population and the climate-physical environment. The palace of Khdewedj El Amia is one of the majestic palaces located at the Casbah of Algiers and constitutes the subject of this article whose objective is to decode its genome in order to understand the social logic of a space inhabited and designed by a princess who lost her sight. Hence the name El Amia, which means blind in Arabic. The decoding of this building used the space syntax approach via a visibility graph analysis (VGA) performed by the Depthmap tool and a quantitative analysis of the graph justified by the Agraph tool. It is about taking into account the way in which vernacular architecture can stimulate the direct perception of space and participate in the construction of the user's path. It was found that the palace is made up of two entities; one is of public order highlighting the resident/alien interface, and another intended for the private apartments, the harem of the princess, isolated from the outside world.

Introduction

Ottoman architecture in Algeria features a great diversity, essentially composed of three typologies: religious, military, and civil architecture, including the palaces which are architectural masterpieces. The Casbah of Algiers is an illustrative example of the presence of these three types of architecture that remain a living lesson in the vernacular architecture dating from medieval times. The palaces and residences of Algiers from the Ottoman era, considered to be architectural gems, can be found amidst the ruins of the Casbah, but are unfortunately disused and converted into museums or administrative headquarters. These palaces served as residences of notables or as high places of the exercise of political power during the Ottoman regency.[1]

Dar Khdewedj El Amia is one of them. It is a 16th-century house built in 1575 by a naval officer, Rais Yahia, on a disused zaouia of Sidi Ahmed Abdellah ez-zouaoui.[2] In 1789, Hassan, then Khaznadji (Minister of Finance) of the Dey Mohamed Ben Othmane, acquired it to house his blind daughter Khdaoudj, a princess who lost her sight. Hence, the name El Amia, which means blind in Arabic. After the French invasion in 1830, the palace was assigned to the deputy director of the interior and the attorney general. In 1909, it became the private hotel of the first president of the Court of Appeal. Since the independence (1962), the Palace has been the museum of popular arts and traditions.

This architectural heritage, formed by three centuries of Ottoman rule, received little attention from the colonial authorities. Neglected and little considered in the heritage directories of the French period[3] or independent Algeria, it has been insufficiently studied and evaluated (Cherif, 2015). Vernacular space has long been characterized as residual, it sits on the spatial and temporal margins of human settlements, it is not clearly appropriate and does not have a character of permanence. In fact, the vestiges inherited from ancient civilizations should not remain static, dead and locked in tradition (Besse, 2003). A place of the moment, of duration, of rooting and of feeling, this architecture expresses messages, the ways that individuals and groups distinguish themselves, express their identity and their most common ways of hidden thinking (Chiva, 1987).

Nevertheless, this heritage has aroused the interest of several researchers, who have all emphasized its architectural and urban richness (Cherif, 2009; Hadjilah, 2020; Piaton, 2018; Kameche, 2013; Golvin, 1988; Boutabba, 2018), but did not address the social logic behind the design and spatial arrangement of this palace designed for the attention of a person who has lost her sight. From this perspective, we wonder if the building has been rearranged *vis-à-vis* this infirmity to provide an intelligible space, which is easily identifiable by a blind person so that the spaces used by the blind are in the most integrated parts of the palace.

The visual memory of space helps in the recognition of space, but this fact is possible only for sighted people. For the blind, the perception of space requires other sensory dimensions such as smell, hearing, and touch. Knowing the particular modes of the path of a specific person is a heuristic way of approaching the complexity of space and the conduct of accessing it (Deac & Ticala, 2017). Yvette Hatwell has concluded that the spatial knowledge acquired by the blind is exactly the same as that of the sighted. Blindness can cause a delay in the acquisition of spatial skills, but the errors observed and the order in which the acquisitions are made are exactly the same in the blind and the sighted. The cognitive space of the blind is therefore no different from that of the sighted (Hatwell, 2017).

Recent research has focused on the apprehension of space through perception, which consists of organizing and associating infor-

1 Under the Ottoman Regency (1516-1830) the medieval city of Algiers went from being a simple village to an urban center.

2 Religious school where students are accommodated who receive teaching in doctrine and grammar given by master Sidi Ahmed Abdellah ez-zouaoui.

mation drawn from the place that mobilizes the body and the user's sensory acuity through the sensory system. It is about considering the way in which vernacular architecture can stimulate the direct perception of space and participate in the construction of the user's path (Thomas, 1999; Simonnet, 2004; Mouzoune, 2005).

Properly diagnosing and studying this palace quickly placed us at the intersection of perceptual, social and spatial senses. This has led us to systematically use the analysis protocol developed by the "space syntax" approach. We pay spatial attention to the social context within the perceptual in order to offer a theoretical platform that can be relied on to make rational decisions about how the heritage space was designed for any category of people suffering from any disability. The spatial organization and morphology reflect a form of society organization, as well as the representations and values that operate in this society (Besse, 2003).

Material and method

"Space syntax" is a set of theories and tools used to analyse spaces in the built environment. Its aim is based on the fact that spatial morphology influences the distribution of the use of spaces, and that the resulting dynamics in turn condition the social interactions, uses and occupations that develop there. The first publications by Bill Hillier and Julienne Hanson (1984) bring together the basic notions of this theory. The theory has enabled many researchers to develop and broaden the field of its use (Jiang, Claramunt & Klaqvist, 2000). This model directly enters the characterization of historic buildings and the field of archaeology. The work of Quentin Letesson (2009) applies it to the study of Minoan cities of the Bronze Age, Hamouda et al. (2021) apply it to Domus in north Africa, Peter Eeckhout (2013) applies it to the complexes of the cities of the pre-Hispanic Andes, and Eric Duprè-Moretti (2019) extends the concept onto a more global notion, which is that of the anthropization of a mountain according to the movement or dynamic response to the rules emanating from a community.

In terms of architecture, it is a matter of creating a justified graph that can be created by Agraph and which brings out the existence of zones of occupation and of hierarchical movement effects between them. This hierarchy refers to control, freedom, tightness or permeability between different kinds of users. The method can be approached by VGA (visibility graph analysis) that is "the analysis of the set of isovists of a spatial system" (Turner, Doxa, O'Sullivan & Penn, 2000), which has had its source in the work of Benedikt (1979). Through Depthmap, this analysis allows (Turner, 2004) to calculate several configurational properties (connectivity, integration, depth, and control...) and presents the different components of the space on a plan, with shades of colours ranging from blue for low values to red for high values. The strong point of this analysis is the possibility of correlating the visual access of an environment with human preferences in reality (Hillier, 2007) by transforming them into numerical values that make it possible to deduce the social representations of the spaces studied (Hillier & Vaughan, 2007). The configurational properties provide various measures which provide information on the degree of intelligibility of the spaces studied, in order to properly orient and guide the user in his movement in an urban or inhabited space according to these morphological and spatial characteristics (Turner & Penn, 2002).

Integration is a static aggregate measure that measures the ease of reaching that space from any other space in the overall spatial arrangement. It is also an indicator of co-presence which promotes social interactions. From then on, integrated spatial systems generate evolution in social relations by allowing new encounters, while segregated systems are used in conservative modes responsible for structuring and reproducing pre-existing social statuses (Arab & Mazouz, 2018).

Connectivity is a static local metric that indicates the number of connections a space has in relation to other surrounding spaces (Jiang & Claramunt, 2002).

Control is a measure allowing the evaluation of the spatial control potential that a cell exerts locally over the surrounding spaces (Letesson, 2009).

Mean depth provides information on the depth or shallowness of each cell by counting how many steps separate it from the initial space. It is used to calculate the number of steps in the space system (Assassi & Mebarki, 2021).

The basic models of a justified graph refer to the symmetry/asymmetry variables relating to the form of integration, and to the distributivity/non-distributivity variables relating to the form of control.[4] The shape of the graph varies according to the four types of representation to highlight a circulation system in the studied set and to identify the distribution and symmetry, or non-distribution and

3 From 1830 to 1962, when Algeria gained independence.

4 Distributivity index = (a+b) / (c+d). Symmetry index = (a+d) / (b+c). The values a, b, c and d correspond to the number of spaces of type-a, -b, -c and -d in the system. Low distributivity index indicates a distributed system, high index indicates a non-distributed system. Low symmetry index refers to asymmetry, high index refers to symmetry.

FIG. 2 LOCATION OF THE CASBAH OF ALGIERS AND OF THE STUDY SITE THE KHDEWEDJ EL AMIA PALACE

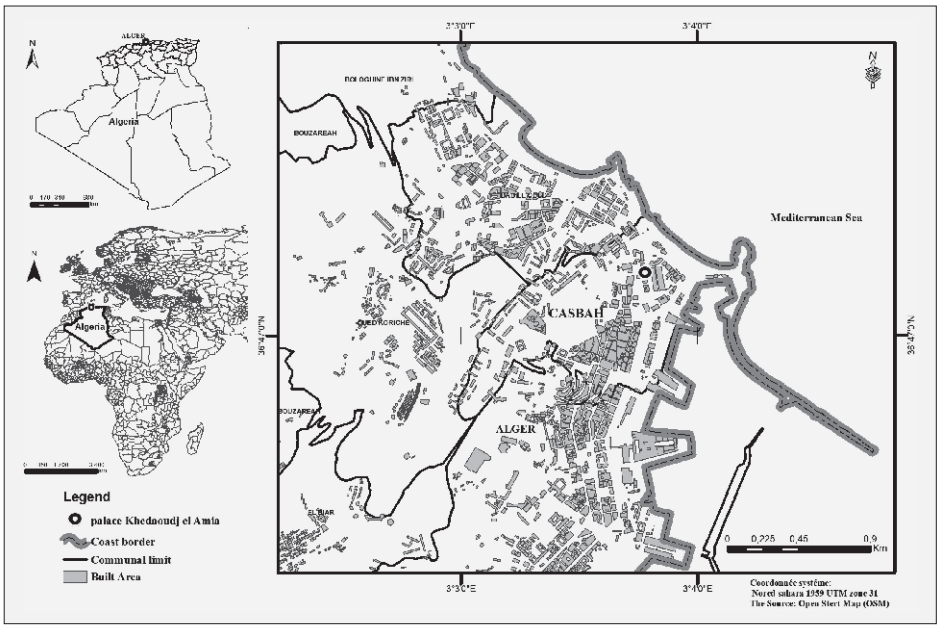

FIG. 3 LOCATION MAP OF THE PALACE "KHDEWEDJ EL AMIA"

asymmetry, of the structures or cells contained in this set: a-type: single bond or dead-end-space; b-type: multiple links serving type a, which denotes a strong round trip flow control through the same point; c-type: multiple links on a single ringy path with therefore a different choice of return path; d-type: multiple links comprising at least two rings indicating a less controlled flow with a large choice of outward or return routes and the topological depth of the different elements (Duprey-Moretti, 2019).

Space syntax theory makes the connection between the physical form of space and its social significance through two parameters: perception and action, which are the basis of human behaviour, and especially in the social aspect, environmental and cognitive.

CASE STUDY

The palace of Khdewedj El Amia is located in the centre of the city of Algiers (capital of Algeria) in the district of the lower Kasbah (Figs. 2-3).

The first space to be introduced upon entering in this palace is the space locally called "sqifa" (Fig. 1), decorated with a fountain once used for ablutions of guests. This entrance is majestic with its marbled, twisted columns, decorated with an acanthus leaf and opening onto a second "sqifa", bordered by a series of benches. "This is where people waited before being introduced to the Dey." We also notice a huge silo, "the mekhzen", where wheat and grains were stored at the time. The floors open onto the sun-drenched patio "waste'dar". Marbled and twisted columns, walls covered with earthenware in the colours of ochre yellow, emerald green and Egyptian blue. Stairs lead to the different floors with four bedrooms each, where we discover the ballroom, the most spacious in the palace. Under colonial administration, the space underwent transformation such as the laying of parquet floors, the installation of French windows and a fireplace. The stucco lace ceiling and openwork domes covered with glass roofs are additions (Mouffok, 2018).

The plan is formed by two wings (Fig. 4), each organized around a patio, probably revealing that the palace is the result of the twinning of two contiguous buildings and that the two entities have undergone several transformations to give the current form.

RESULTS

The spatial organization of buildings is strongly correlated with the model of use and occupation of different spaces. It directs the flow of movement and orientation of individuals within a physical environment (Cuisenier, 1991; Hillier et al, 1993; Turner & Penn, 2006). The simulation results of the spatial analysis made on the basis of the modelled plans of the palace, using DEPTHMAP and AGRAPH, shall be studied according to the degree of depth of connectivity, integration and control.

VISUAL ANALYSIS

- **Visual integration** – The syntactic map of integration of the ground floor of the Kh-

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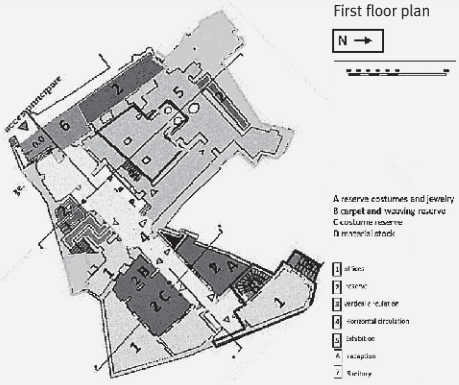
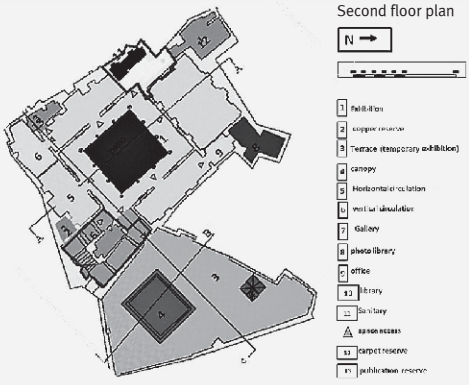
FIG. 4 GRAPHIC MAPS OF THE DIFFERENT LEVELS OF THE PALACE

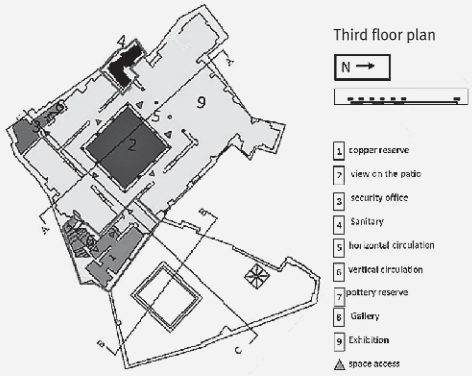
First floor plan



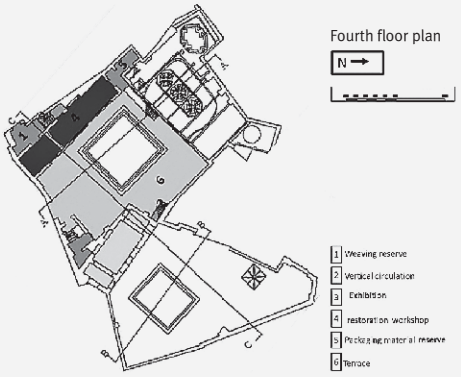
Second floor plan



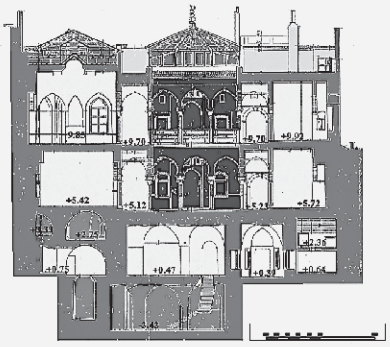
Third floor plan



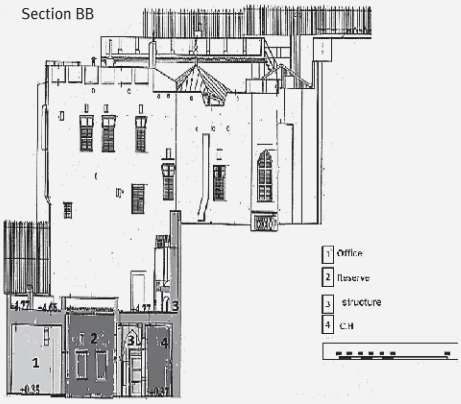
Fourth floor plan



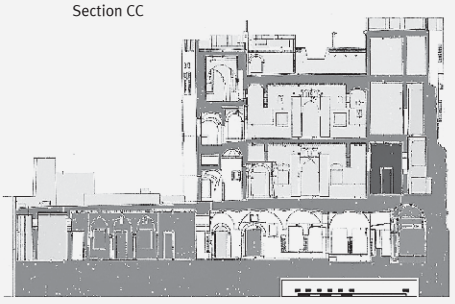
Section AA



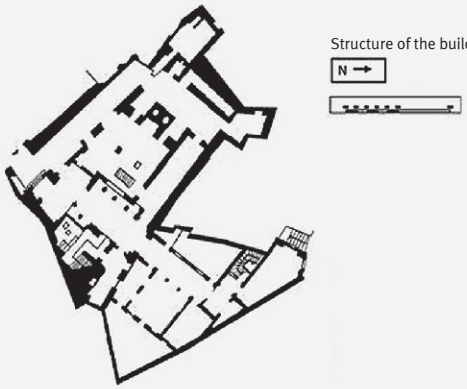
Section BB



Section CC



Structure of the building



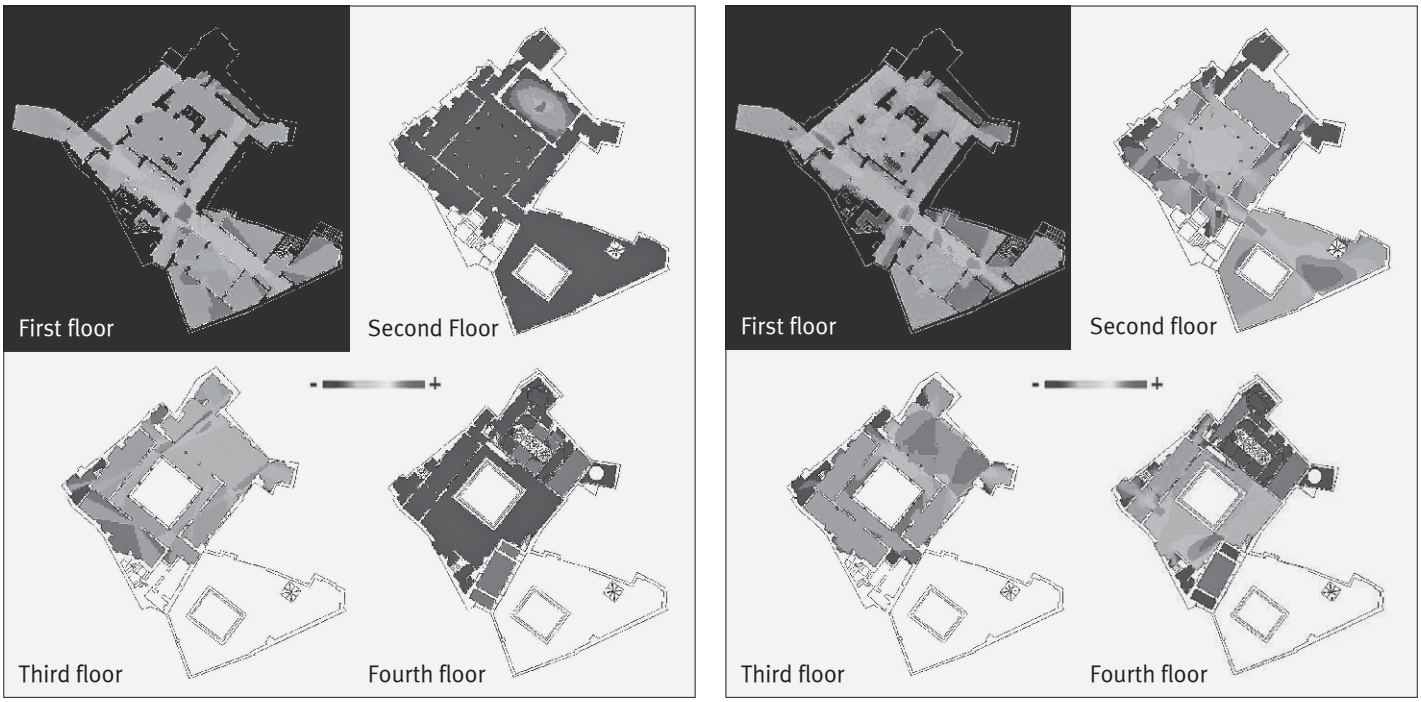


Fig. 5 Maps of the visual integration of the Khdewedj El Amia palace

Fig. 6 Visual connectivity maps of Khdewedj El Amia Palace

dewedj El Amia palace shows maximum values of integration at the level of the gallery and the "Sqifa", which is a static functional space. The degree of integration is clearly repeated at two levels (Fig. 5), going towards the extension that the original palate underwent. The gallery which connects these spaces seems to be strategic because it both allows having a distant view from the entrance and gives access to many important spaces. The spaces that exhibit the most segregated values of integration are located at all the ends of the palace and correspond with the interior of the rooms as well as the storage spaces. For the second level, a single room offers a considerable degree of integration in its heart. This space is clearly a privileged room (living space) as its dimensions are larger than the rest of the rooms and its spatial characteristics allow the visibility only once inside.

The integration map obtained from the third level VGA analysis shows two considerable integration peaks occupying the two sides of the room transformed into the ballroom during the French occupation. It was the living space of the first floor. This space seems to be remarkably strategic by: the absence of physical obstacles and its opening onto the gallery which opens onto the patio on the lower level, as well as by the dimensions of this room in relation to the rest. At the same time, other spaces with an additional function are segregated and they are characterized by the impermeability responding to their social character of intimacy.

• **Visual connectivity** – Through the reading of the visual connectivity map corresponding to the VGA analysis, a strong correspondence between the maximum results obtained in the integration map of the first level, peaks in the degree of connectivity scattered over the gallery considered to be the main space (Fig. 6). The spaces that represent the highest connectivity values are the open spaces located on the lateral sides of the patios, as well as the terrace of the second floor which does not observe any obstacles and therefore has one of the best connectivity in the plan. The second level connectivity map shows values that do not have the same distribution of integration values, the most connected space coincides with the first gallery which welcomes upon the arrival of a person rising from the stairs. The more you move from the patio to the surrounding rooms, the more the connectivity of the spaces decreases. For the third level, the ballroom is the most connected space. The value is also important at the level of the gallery which borders this same clearly privileged space. As for the two other floors, the less connected spaces are the deepest ones, which puts them in hiding in relation to the visual field of the users. Spaces with the highest connectivity values are expected to be more accessible from different directions and may offer more possibility of orientation choice for users, so these spaces are expected to be used more often than others.

• **Visual control** – The palace control chart presents results very similar to those ob-

tained in the two previous analyses (Fig. 7). The most integrated spaces of the building's spatial system are most connected and at the same time those with the highest values of control. These spaces are clearly located at the level of sqifas, circulation spaces, and at the intersections of passages. For the assimilation of the degree of control, we wish to underline that for the three floors the spaces which have the highest values are the spaces controlling the spatial system. These are in parallel the most integrated and visually connected with respect to the other spaces having minimal degrees of controls. These characteristics mean that each locally connected space can be globally integrated into the entire spatial system, which means that these spaces are most passed through, travelled, chosen, and used by users, and are meant to be the places that facilitate all tasks relating to orientation.

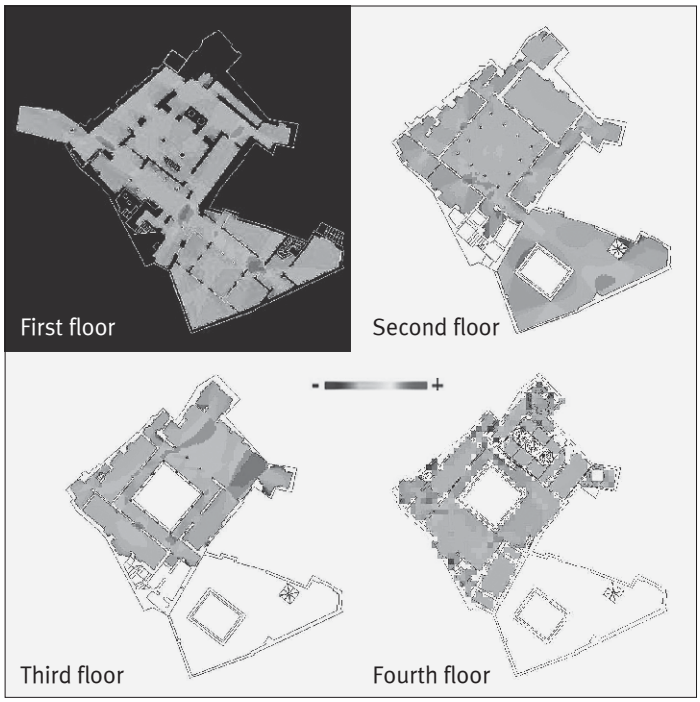


Fig. 7 Visual control maps of Khdewedj El Amia palace

Quantitative analysis

To refine the analysis, Agraph software was used to give more detailed results for each convex space constituting the system. Each level was translated into a justified graph from which the numerical values of the depth, integration and control of each space were highlighted.

The justified graph is more complex compared to those of other levels, it is an amalgamation of tree and ring configurations; symmetric, asymmetric, distributed and non-distributed with a distributive index of (0.91) and a symmetry index of (1.1). These are very low values and the asymmetric non-distributed configuration wins out.

Two access points inside, probably a main entrance and a secondary service entrance offering quite a lot of flexibility in terms of traffic and consequently losing control potential. From the main entrance, a sequence of b-type spaces (sqifas) is deployed in a distributed asymmetric system attesting to the existence of a subtle and complex management of circulation to differentiate the interface between residents and between residents and visitors. The distribution is local and manifests itself at the level of the bedrooms and the kitchen with a local effect and accentuating the segregation of these spaces.

External ringy configuration is an annularity that only exists with regard to the relationship between interior and exterior and is often considered a powerful interpretive vector, especially with regard to the relationships between residents and visitors. This ring is notably made up of sqifas (first space of access to the interior in the Arab Muslim culture) and galleries as spaces of transitions and they are the most important spaces in terms of the mediation between the two internal and external spheres and it is an important pivot of circulation within the building (Hillier & Hanson: 1984, Letesson: 2009). An annular system can have two essential functions overall: it can offer various choices of movement to people living there, but it is also used to ''register within the building the different circulation models of the different user groups (Hanson, 1998). The service access is controlled by the sqifa while the main access is controlled by the succession of two elbow-shaped sqifas, emphasizing the desire to establish a clear line between the inside and outside and an enormous concern for control. From the first sqifa to the second gallery, the control value increases exponentially (Fig. 8 and Table I). The gallery 1 is the most integrated space and illustrates the concept of spatial solidarity, it articulates the circulation to the other rooms and by its layout offers a framework particularly suited to meetings between residents, but especially to the reception of visitors who are much more controlled by gallery 2, which shows the highest control rate of (4.36) and serves the upper levels probably occupied by the blind princess.

The second level displays a tree-justified, non-distributed and symmetric graph at each depth level with a very high distributive index of around 17 and a very low symmetry index of around 1.42. B-type spaces exert a certain potential for control; first are the stairs, then the gallery on a global scale and then the rooms on a local scale (Table II).

TABLE I NUMERICAL DATA OF THE FIRST FLOOR OF KHDEWEDJ EL AMIA PALACE

	Type space	Mean Depth	integration	Control value
ext	c	3,3	4,13	1
sqifa1	b	3,15	4,41	0,83
sqifa2	c	2,4	6,78	0,9
galery1	d	1,95	10	2,17
galery2	d	2,1	8,63	4,36
stairs	b	2,8	5,27	1,2
floor2	a	3,75	3,45	0,5
court1	c	2,25	7,6	2,28
room2	c	3,05	4,63	0,45
room3	c	2,95	4,87	2,7
niche1	a	3,9	3,27	0,25
niche2	a	3,9	3,27	0,25
room4	a	3,2	4,31	0,2
room1	a	3,05	4,63	0,14
sqifa3	d	2,85	5,13	0,64
stock1	a	3,05	4,63	0,14
court2	c	2,9	5	0,97
kitchen	c	3,8	3,39	0,66
stock2	c	2,9	5	0,97
sanitary	a	3,05	4,63	0,14
stock3	a	2,9	5	0,2
mean		3	5,14	1

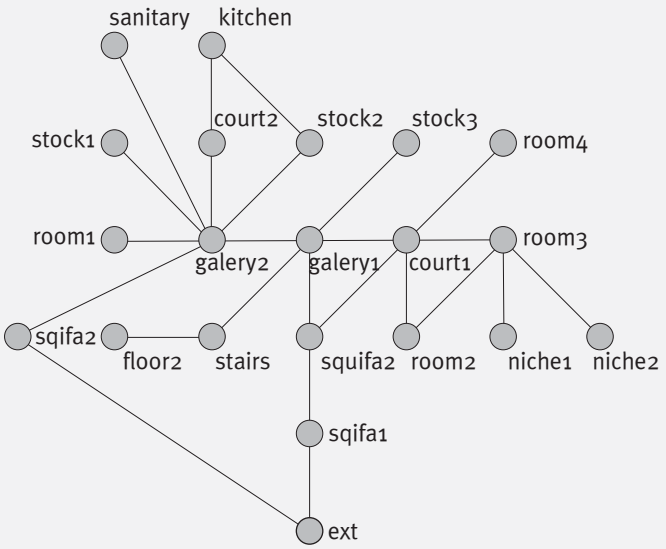


FIG. 8 EVALUATION OF THE SYNTACTIC VALUES FOR EACH SPACE OF THE FIRST LEVEL OF THE PALACE.
IN THE FIRST LEVEL, GALLERIES, SQIFAS AND COURTYARDS DISPLAY THE HIGHEST DEGREE OF INTEGRATION (I) AND CONTROL (CV) AND LOWEST DEGREE OF DEPTH (MDN), COMPARED TO ROOMS AND OTHER ADDITIONAL SPACES.

The symmetrical tree structure means that there is a tendency to integrate social categories which target the relationship between residents and non-distribution indicates a trend towards a super-ordered unitary control. It is the domain of the inhabitants with very strong sanctions against the penetration of visitors. Within such a structure the circulation options are minimal.

Access to this level is via the stairs which display the highest control value followed by the gallery (Fig. 9). This transition space, being a generator of symmetry, helps to isolate the cells constituting the floor, without blocking communication between them by being a pole of convergence. Four main rooms are served by the gallery, each occupies one side of the square, three of which have a succession of spaces in a "Russian doll" type model, which allows extraordinary mastery of the degree of control authorized in each room of the palace and thus master the connectivity desired for each type of visitor.

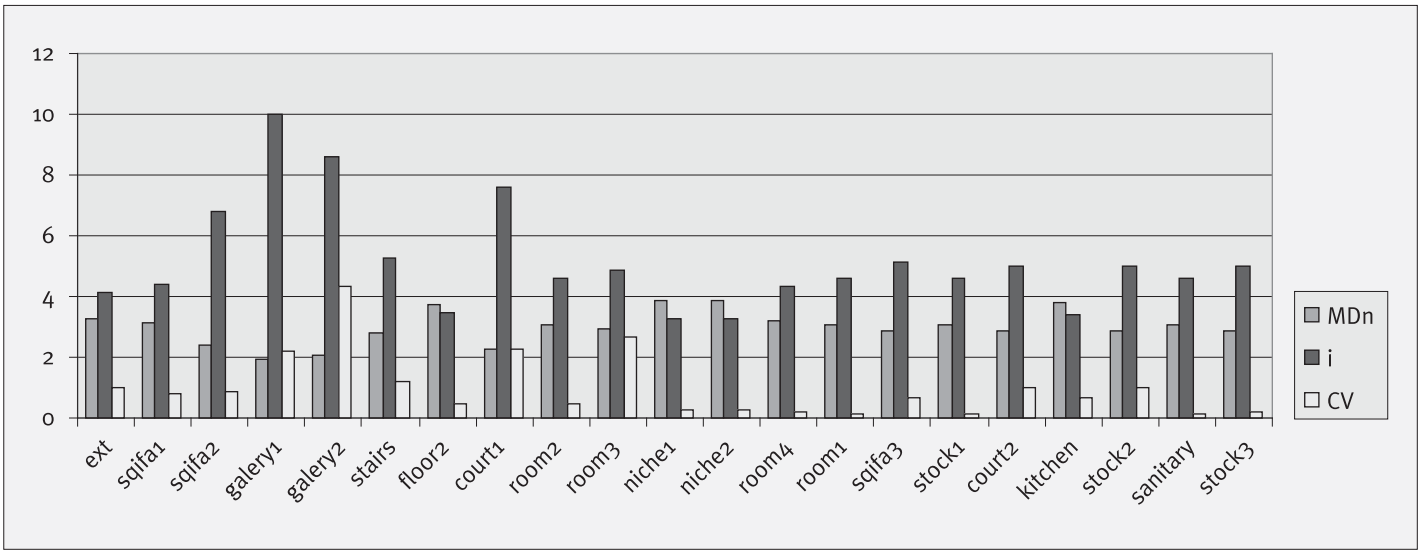
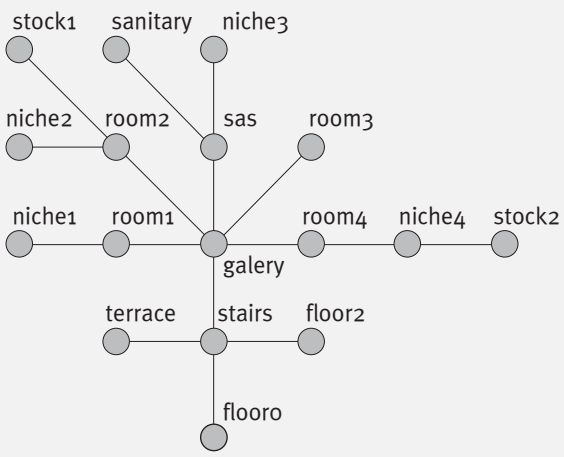


Table II Numerical data and justified graph of the second floor of Khdewedj El Amia palace

	Type space	Mean depth	Integration	Control Value
flooro	a	3,18	3,42	0,25
stairs	b	2,25	6	3,16
galery	b	1,68	10,9	2,91
terrace	a	3,18	3,42	0,25
room1	b	2,5	5	1,16
niche1	a	3,43	3,07	0,5
room2	b	2,37	5,45	2,16
niche2	a	3,31	3,24	0,33
stock1	a	3,31	3,24	0,33
sas	b	2,37	5,45	2,16
sanitary	a	3,31	3,24	0,33
niche3	a	3,31	3,24	0,33
room3	a	2,62	4,61	0,16
room4	b	2,37	5,45	0,66
niche4	b	3,18	3,42	1,5
stock2	a	4,12	2,4	0,5
floor2	a	3,18	3,42	0,25



The third level of the palace has less spaces and displays a non-distributed asymmetric justified graph with a tree structure at the fourth level of depth (Table III), showing a symmetry whose pole of convergence is the gallery which overlooks the central courtyard and which has the highest control value (Fig. 10). Generator of symmetry, this space helps to isolate certain activities from one another, but by being a powerful vector of circulation. The global configuration can immediately be referred to through the concept of trans spatial solidarity, i.e. a form of solidarity achieved through the control of categories in isolation rather than the interpenetration of categories through spatial contiguity and random movement (Hillier & Hanson, 1984). The rooms evolve asymmetrically just like the second level with the presence of a trivial ring with local effect connecting two rooms between them.

According to Fig. 10, the circulation spaces are the best integrated ones in the system and ensure the highest controllability effect, while other spaces display balanced degrees of depth integration and control, forming occupancy spaces with local movements according to the configuration of the space giving a more private aspect to these spaces.

The terrace, on the fourth level, as an open-air space, has a privileged location in the spatial distribution of the palace, at its level, it is superficial, very well integrated and exerts strong control over the movements that lend

Fig. 9 Evaluation of the syntactic values for each space of the second level of the palace: Degree of integration (i) and control (CV) and the lowest degree of depth (MDn)

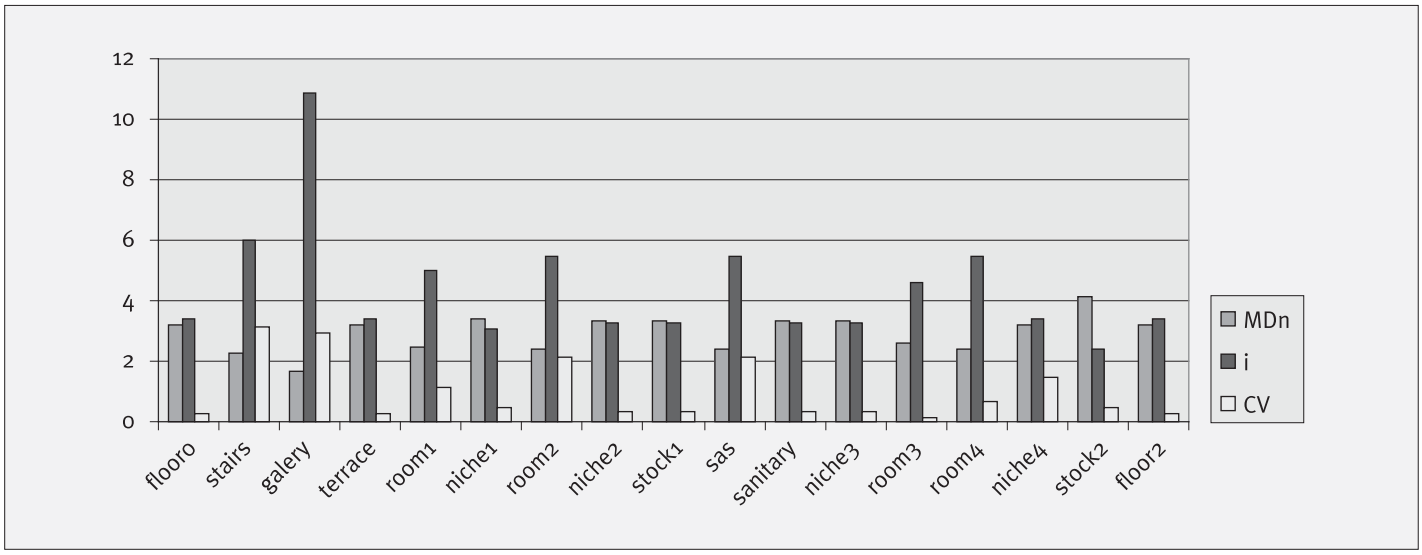
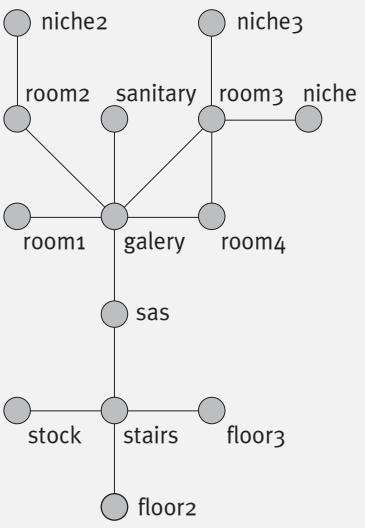


TABLE III NUMERICAL DATA AND JUSTIFIED GRAPH OF THE THIRD FLOOR OF KHDEWEDJ EL AMIA PALACE

	Type space	Mean Depth	Integration	Control Value
floor2	a	3,46	2,43	0,25
stairs	b	2,53	3,9	3,5
stock	a	3,46	2,43	0,25
sas	b	2,07	5,57	0,41
galery	c	1,76	7,8	3,75
room1	a	2,69	3,54	0,16
room2	b	2,53	3,9	1,16
niche2	a	3,46	2,43	0,5
sanitary	a	2,69	3,54	0,16
room3	c	2,3	4,58	2,66
room4	c	2,46	4,1	0,41
niche3	a	3,23	2,68	0,25
niche	a	3,23	2,68	0,25
floor3	a	3,46	2,43	0,25



themselves to it (Fig. 11). The justified graph (Table IV) is strongly asymmetric and non-distributed. Cell organization with simple linear sequencing of b-type spaces is a way of configuring a building for the sake of maintaining a certain distance from the outside world and compared to other levels of the palace.

DISCUSSION

According to the justified graphs of different floors, the one on the ground floor stands out from the others by its annular configuration which is used to give the user the choice of movement and the possibility of a freer exploration of the interior of the building (Hanson: 1998). Namely, an annular system is a distributed system, that is to say, it is a set of spaces through which the visitor can pass, subject to more or less extensive control (Hillier & Hanson: 1984). This gives it the public character of the fact that it favours the residents / visitors interface. At the higher levels, the privacy prevails and is illustrated by the asymmetric tree configuration of the justified graphs and the sequential movement which refers more directly to the sphere of relations between residents (Hanson: 1998) and the strict control of movement.

The first observation relates to the role that intimacy and the social framework play in the spatial configuration and the characterization

FIG. 10 EVALUATION OF THE SYNTACTIC VALUES FOR EACH SPACE OF THE THIRD LEVEL OF THE PALACE: DEGREE OF INTEGRATION (I) AND CONTROL (CV) AND LOWEST DEGREE OF DEPTH (MDN)

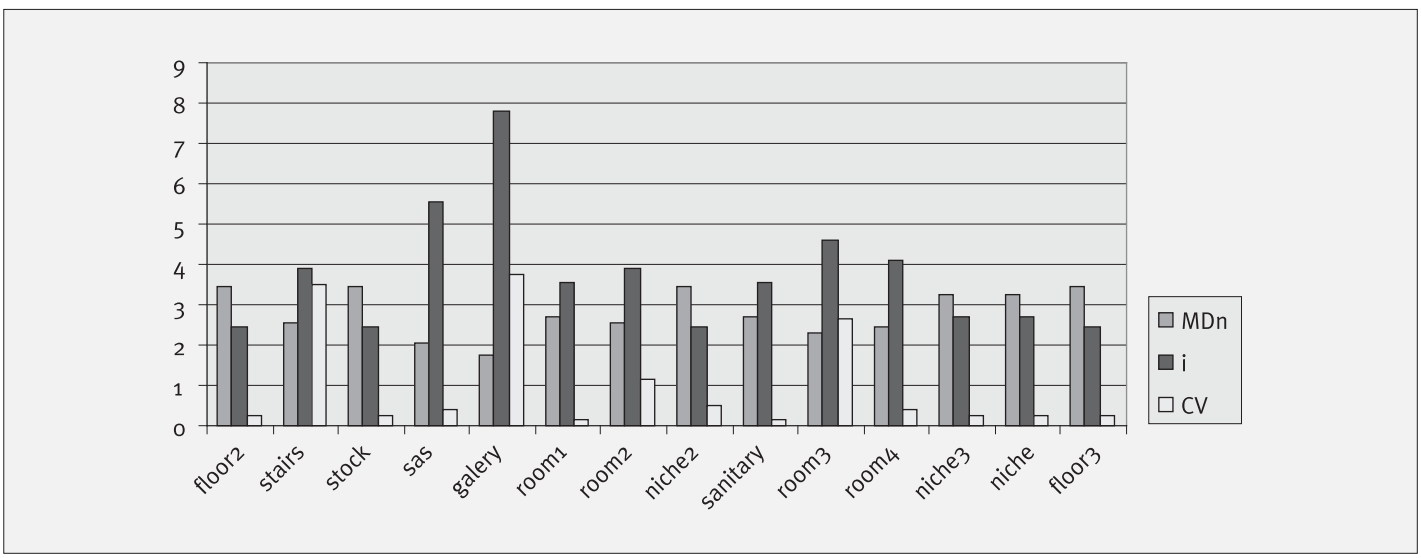
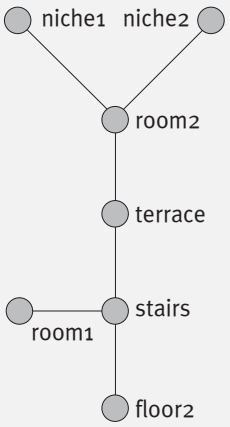


Table IV Numerical data and justified graph of the fourth level of the Khdewedj El Amia palace

	Type space	Mean Depth	Integration	Control Value
floor2	a	2,66	1,5	0,33
stairs	b	1,83	3	2,5
room1	a	2,66	1,5	0,33
terrace	b	1,66	3,75	0,66
room2	b	1,83	3	2,5
niche1	a	2,66	1,5	0,33
niche2	a	2,66	1,5	0,33

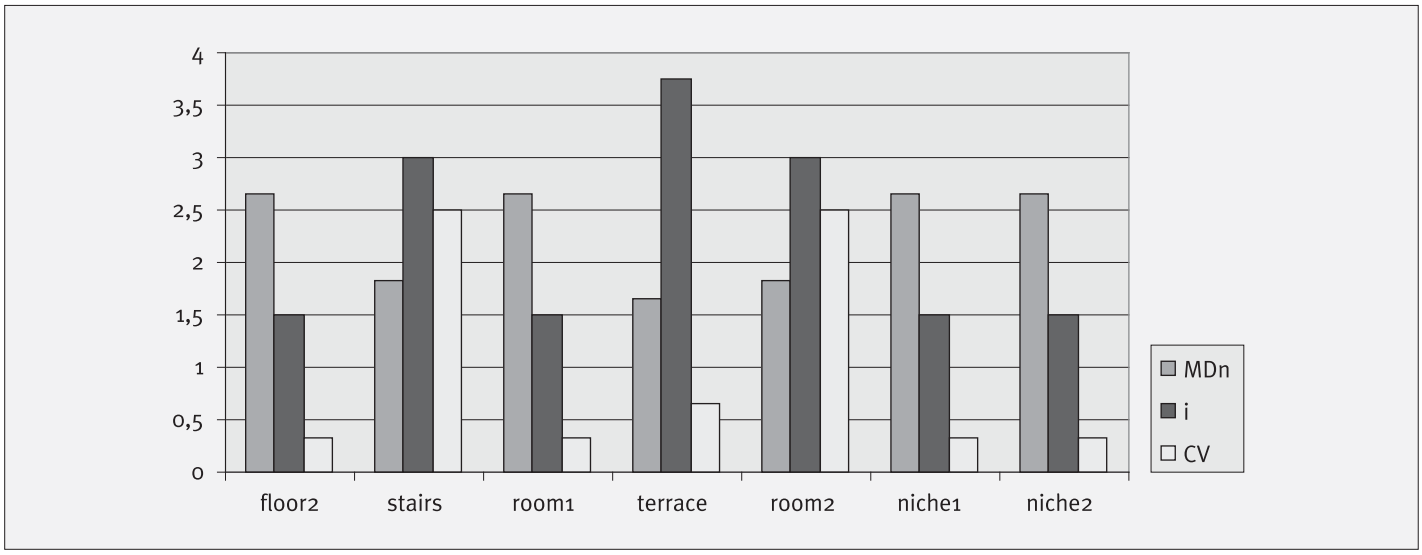


of its integrative properties. The spatial configuration of the terraces rejects it to integrate with the rest of the house, but all very well controlled from the inside of the building.

For the bedrooms, the result in relation to this space mainly relates to the role that the transparency of the gallery overlooking the patio of the palace plays in improving the configurational properties of the space. The situation of a hardly visible space, and little connected, integrated or more controlled by the rest, gives a hidden spatial image. In the background it can be intended for a function requiring these needs for depth and intimacy.

According to Rachel Thomas, locomotion without vision follows the following modes of movement: crossing, avoiding obstacles, entering or leaving a space, ensuring its positioning and the straightness of movement. In this sense, it should be understood that the tree-like organization, strongly adopted from the second level, is a relatively elementary way of configuring a building for the sake of maintaining a certain distance from the external world, as well as for the sake of establishing a clear architectural framework, easy to read and less ambiguous to use, especially for the blind. In the case of the tree like system, the poles of convergence are generally formed by a symmetrical arrangement of subordinate cells with an occupational character of a-type to b-type pivot space (gallery; Letesson, 2009). Being of public use the first level, the annular configurations of the first level multiply and highlight the resident-visitor interface. The resident of the palace, in this case Khdewedj El Amia, should probably use the upper floors which are easily understood, compared to the first level which is used by the staff working in the palace.

Fig. 11 Evaluation of the syntactic values for each space of the fourth level of the palace: Degree of integration (i) and control (CV) and lowest degree of depth (MDn)



Conclusion

This study was carried out with the main objective of revealing the sensitive dimension of the palace architecture dating from the 16th century and intended for a blind person in order to compensate for this lack through a pleasant space to live in. Another objective was to show how an ordinary perception reveals the vernacular space in its constructed and sensitive qualities.

Indeed, all you have to do is put your foot in it to confirm the feeling of a real living space providing total pleasure, preventing a sighted or blind user from falling into a feeling of insecurity or disorientation. The way in which the spaces were distributed according to the social logic of the era affected the human sensory as well as bodily experience. The succession of the baffled "sqifa" spaces facilitates the gradual control of movement within the palace, by allowing visitors to enter the space while preventing them from going further inside and reaching the private spaces. The transparency of the courtyard ensures the second degree of control. In fact, the galleries which surround it are very well connected to the private spaces with the right angles and affecting a bedroom at each side of the square of the patio. The bedrooms themselves exercise the third degree of control over the niches: spaces annexed to the bedrooms which should have more intimate functions.

The methodological process adopted is an approach that seems most appropriate and that has quickly made it possible to extract the configurational characteristics of a building with a specific destination. The syntactic analysis with Depthmap and Agraph gave the opportunity to know the tendencies of a user in terms of movement in a space and the choice of route in relation to the spatial connectivity offered to him. The characteristics and properties of static spaces with a degree of control, integration, and high connectivity, must be exploited to provide a space that is easy to decipher and less ambiguous to use.

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All authors have read and agreed to the published version of the manuscript.