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Traditional Aurassian Architecture: A Harmony Between Identity, Environment, and Society

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Abstract

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The traditional Aurassian architecture is distinguished by its unique response to local social, cultural, and environmental needs. This study aims to explore the specificities of this architecture, focusing on how it integrates factors such as beliefs, social relationships, climate, materials, and economic resources to create a distinctive habitat. The Aures landscape is structured into three types of settlements: scattered, semi-dispersed (mechta), and clustered (Dechra), characterized by vernacular architecture using ancestral techniques. The analysis focuses on the Chaouia house, known as "taddart," a hierarchical social and economic space that demonstrates optimal adaptation to the local context. The methodology is based on a comparative study of vernacular architectural practices and their socio-cultural influences. The results highlight the importance of integrating these principles into contemporary housing for better quality of life. This research contributes to the valorization of Aurassian architectural heritage by proposing solutions to revitalize modern housing while respecting its traditional roots.

Keywords: Aurassian Architecture; Vernacular Habitat; Socio-Cultural Factors; Architectural Heritage; Aures landscape.

1. Introduction

Traditional architecture serves as a valuable testament to the diversity of cultures and ways of life. Passed down through generations, it is deeply rooted in the specificities of a community, a region, or a country. More than relics of the past, these structures reflect the ingenuity of societies in adapting dwellings to climatic constraints and daily needs.

Far from being mere relics of the past, these structures embody the innovative spirit of societies, offering insights into the adaptive techniques employed in response to environmental and social challenges. This enduring legacy makes traditional architecture a vital area of study, providing a window into the values and lifestyles of different cultures.

The Aurès region, situated in eastern Algeria, the Aurès mountain range constitutes one of the most prominent massifs of the Saharan Atlas. This rugged region is traversed by four main valleys that serve as natural corridors and communication routes: the valleys of Oued El Abiod, Oued El Arab, Oued Abdi, and Oued El Kantara (Djezzar & Bada, 2023). These valleys converge to form Oued Zarzour, which flows through the city of Biskra before ultimately merging with Oued Djedi in the Sahara. This intricate topography has given rise to numerous traditional villages scattered throughout the Aurès region (Barrou, 2019).

The climate in the Aurès is marked by extremes, with hot, dry summers characterized by sharp temperature variations and cold, rainy winters often accompanied by snowfall. A persistent wind, dry in summer and icy in winter, sweeps across the region throughout the year. Water resources in the Aurès are divided into two primary types: underground sources such as the springs of Thit, Thacharcharth, and Thaouinth, and surface water sources like Oued Abdi and Oued El Abiod.

The Aurès has long been a challenging region for sedentary life due to its arid landscape and limited resources. Historically, the Chaoui people of the Aurès practiced semi-nomadism, driven by the need to rear sheep and goats. Their settlements are often located on isolated and rugged heights, with houses clinging to mountain slopes and forming terraced clusters overlooking the valleys. During nomadic periods, the Chaouis lived in tents, huts known as "gourbis," or in natural rock caves called "afris." These caves, often perched at high altitudes, were nearly inaccessible and secured with stone walls or shrub barriers. Over time, these dwellings evolved into more permanent structures built using clay, wood, stone, and dried earth (toub), reflecting a gradual shift toward a settled lifestyle.

The daily lives of the Aurès' inhabitants are deeply rooted in their cultural traditions. The region's industries include jewelry making, pottery, and weaving, which continue to be practiced using traditional methods. Clothing reflects practicality and cultural identity, with men donning burnouses and self-made alfa grass sandals called "Arkess," while women adorn themselves with "Alhafa" earrings and "Khalkhale" anklets, emphasizing the community's artistic flair. Food habits in the Aurès are shaped by resource availability. While meat consumption is minimal, dates are a dietary staple, particularly in southern areas. Traditional Chaoui dishes, such as "Seksou", "Thachekhchoukhthe", and "Aghroume", remain integral to the local culinary identity.

The social organization in the Aurès is hierarchical, fostering a strong sense of community and solidarity. Families form small groups known as "Décheras," which combine to create "Douars." Several Douars then form larger tribal entities called "Arches." The tradition of "Thwisa," a collective mutual aid system, reinforces the community's cohesion and ensures collective support in various social and economic activities.

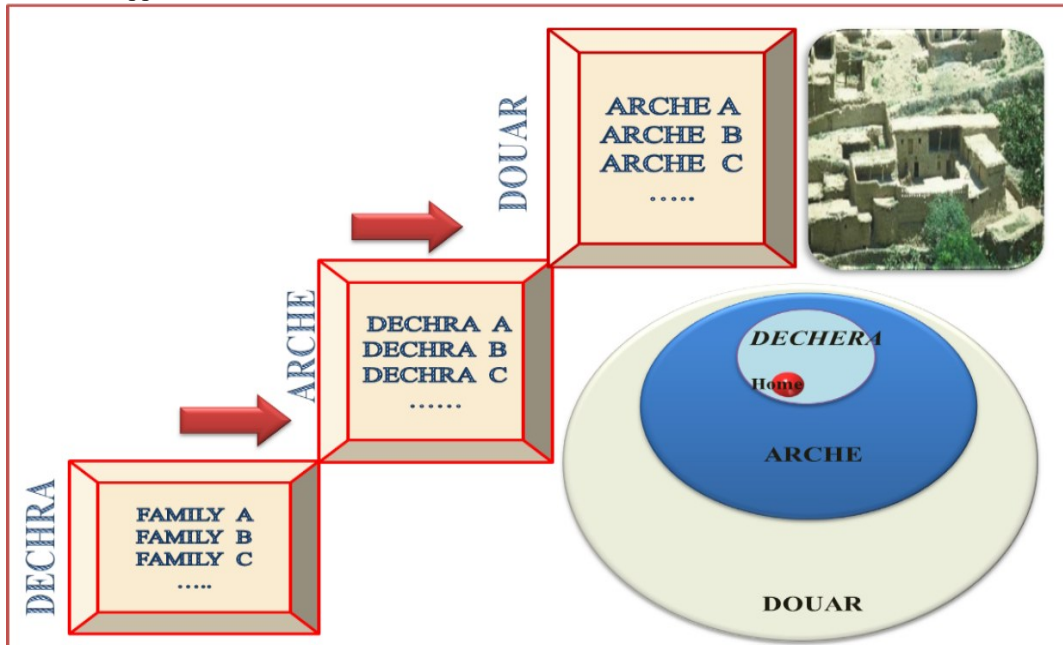


Figure 1. The social organization in the Aurès (Developed by Author).

In the Aurès region, during the 1960s and early 1970s, traditional human settlements experienced a noticeable decline. Some of these settlements collapsed entirely, while others were less severely affected. This decline was largely driven by the disappearance of certain local activities and a significant rural exodus, which were further exacerbated by the deterioration of the built environment (Barrou et al., 2017). Together, these factors contributed to the complex challenges facing the old Eurasian urban centers.

However, beginning in the 1980s, a reversal of this trend took place, thanks to a series of special government programs aimed at revitalizing the region. This led to a phase of urban renewal in many of the area's towns and villages. Traditional structures were gradually demolished and replaced, while streets were redrawn and, in many cases, widened.

This process of urban recycling occurred spontaneously, as residents were compelled to rebuild on the inherited and already-occupied plots of land, maintaining continuity with the past while adapting to contemporary needs.

While traditional housing has garnered significant research interest—as evidenced by studies on spatial structure, architectural transformations, and rural housing evolution (Benbouaziz, 2011, 2019; Hamouda, 2013; Assassi & Bellal, 2016)—critical aspects such as natural light optimization remain underexplored. This oversight has resulted in introverted houses in Aurès with blind facades and poorly lit interiors, leading to unsatisfactory living conditions. The Research questions are:

- Why is it important to study the design process of traditional Aurèsian houses? And what makes Aurèsian architecture unique?
- What processes contribute to this architectural specificity? And what are the key factors governing the design process of Aurèsian houses?
- How can socio-cultural factors be integrated into the housing design process?
- How can traditional architectural elements be borrowed, reintroduced, or adapted into conventional housing design?

This study hypothesizes that the luminous quality of traditional housing is determined by spatial configuration and design choices. The objectives are to:

1. Identify traditional techniques for optimizing natural lighting.
2. Assess their impact on occupants' quality of life.
3. Propose sustainable architectural solutions that integrate tradition with modern comfort.

This paper aims to bridge the gap between traditional architectural practices and contemporary needs. Structured into five sections, it includes an overview of materials and methods, a presentation of results, discussions contextualizing findings, and a conclusion highlighting implications and recommendations. Our communication aims to:

- Identify the underlying causes and remedies to the observed issues by studying the evolution of traditional architecture and highlighting its essential social role.

- Extract the core elements of the design process of Aurès traditional architecture to better define spaces suited to contemporary needs.
- Improve performance in terms of economic efficiency.
- Revitalize inhabited spaces and make them more compatible with modern lifestyles.
- Facilitate the integration of sustainability criteria, ecological principles, and physical quality standards.

2. Material and Methods

This study adopts a combined qualitative and quantitative approach to analyze the selected case studies using a variety of research techniques. The qualitative approach involves multiple methods aimed at addressing the research questions and achieving the defined objectives. To this end, on-site observation is employed to gather necessary information, with a particular focus on the spatial organization and construction systems of the traditional Aurès house.

The quantitative approach is implemented through the use of syntactic analysis, allowing for a structured examination of spatial configurations. Together, these research methods are primarily used to assess the impact of both the visible and invisible aspects of the different spaces within the traditional Auresian dwelling.

The syntax of space functions as a language of thought and speech; it represents a dialogue between the architect and the designed environment. Therefore, space is not merely a backdrop for human activity or a setting for objects—it is intrinsically tied to human actions and becomes one of their fundamental components. It embodies a unique dimension: the dimension of life (Hillier & Vaughan, 2007).

All human activity is inscribed in space: people move in straight lines, gather in convex spaces, and perceive the built environment through visual fields known as isovists (Karimi, 2012). In this sense, the environment is defined as a composition of real, visible surfaces in space. Visibility refers not only to what can be seen, but also to the mediating process that connects humans to their environment—an interaction between space and light.

Natural light thus becomes an essential and irreplaceable factor in achieving high-quality luminous environments. Unfortunately, it is often poorly integrated and inadequately considered in traditional houses, which negatively affects visual quality and visibility. This in turn may cause visual, lighting, and psychological discomfort (Bouandes & Mazouz, 2019).

Visibility Graph Analysis (VGA) examines all isovists within a spatial system, enabling the calculation of various configurational properties derived from the spatial dataset. This method provides both global and local metrics (Turner, 2005), visualizing the spatial components in a floor plan, where each zone is assigned a color corresponding to its configurational value.

An isovist is defined as the set of all points visible from a specific vantage point within a given environment (Benedikt, 1979). Analyzing isovists allows us to assess the visibility and describe the visual and socio-spatial qualities of space based on their geometric properties (Bouandes & Mazouz, 2019). Each isovist, associated with a viewpoint, forms a polygon that contains every line segment connecting its points to that viewpoint. This topological property simplifies the study of isovists by reducing it to the analysis of its boundaries (Benedikt, 1979).

In practical terms, visibility is evaluated through a visual field that encompasses the various attributes of the isovist. Visibility is considered better when the visual field is large, this is often proportional to the isovist's area and perimeter. Conversely, when occlusivity increases (when visual obstacles are present) visibility diminishes due to partial or total blockage of objects. Finally, the more circular the perceived visual field (indicating the absence of visual obstructions), the higher its compactness—a key factor in spatial perception (Turner, 2007).

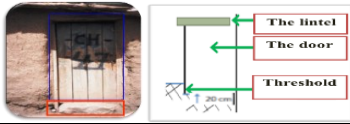



3. Results

The architecture of the Aurès exemplifies the community's ability to adapt to its environment while maintaining cultural authenticity. Traditional homes are designed and built by the inhabitants themselves, making them both creators and users of the space (Softaoğlu, 2019; Softaoğlu, 2021). This self-sufficiency extends to the construction process, which is typically a collective endeavor supported by the principle of mutual assistance, known as "Thouiza."

Aurèsian houses are characterized by their integration with the natural landscape, respecting the environment and the privacy of neighboring homes. These structures exhibit continuity in form and color, blending seamlessly with their surroundings. Foundations are built on sturdy substructures, and blind facades (walls without openings) offer protection against harsh climatic conditions. Although aesthetics are not an intentional focus, the resulting architecture is often harmonious and visually appealing, embodying a balance between functionality and cultural identity.


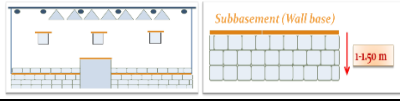
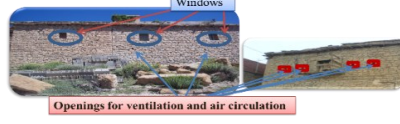
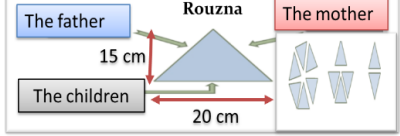


In traditional Aurassian architecture, the concept of transition between public and private spaces holds profound cultural and symbolic significance. The threshold, far from being a mere structural feature, acts as a liminal space where the outside world gives way to the intimate realm of the household. Elements such as the "Amnar" (threshold), the "Thaborth" (entrance door) are thoughtfully designed to balance functionality, protection, and cultural expression. This spatial and symbolic articulation reflects the values of modesty, respect for privacy, and the importance of identity within the Aurassian domestic environment (table 1).

Table 1. The concept of transition between public and private spaces.

Elements	Original name	Characteristics	Schemas and figures
Threshold	Amnar/ Athbeth	It forms a transitional space between the outside and the inside. Once the threshold is crossed, the house is concealed by an askift (chicane entrance).	
A lower threshold		A dual access to the house exists: a lower threshold – A small, low door for animals. – A large door reserved for men. Made of finely crafted cedar wood.	
The entrance door	Thaborth	is oriented to be sheltered from the wind and, if possible, out of sight of passersby.	
The door	Thaborth	The doors are marked with symbols specific to each family group	

The architecture of traditional houses in the Aurès region of Algeria reflects a deep understanding of the environment, material availability, and the cultural values of its inhabitants. One of the most telling elements of this architecture is the treatment of the façade, which reveals a thoughtful balance between functionality, climate adaptation, and symbolic expression. The façade is not merely a vertical barrier; it is a complex interface between interior life and the surrounding landscape. This section explores the components of the façade its solid-to-void ratio, the base construction, window openings (Rouzna), and the chimney and how each contributes to the comfort, sustainability, and identity of the home (table 2).

Table 2. the components of the façade.

Elements/ concepts	Characteristics	Schemas and figures
Façades	Full/Empty Ratio: The percentage of empty compared to full is 20%.	
Subbasement/ Wall base	The lower part of the wall, it is made of mortar stone and earth, with the earth filling the gaps and binding the stones together. Its role is to protect the rest of the wall from water infiltration.	
Openings and Projections in the façade - Windows-	Small openings of various shapes, rectangular (30 x 50 cm), square, or triangular (15 x 20 to 20 x 30 cm), either isolated or in series.	
Rouzna	Different compositions are achieved, either triangular, arranged in a frieze, or in a diamond or hexagon shape, giving the appearance of lattices.	
Openings ventilation air circulation	- Warm air is less dense than cold air. - Rouzna allows the smoke from the chimney to escape.	
The chimney	Is often a simple, yet essential structure, helping maintain a comfortable living environment by allowing smoke to exit while providing warmth during colder months. The design of the chimney is traditionally practical, reflecting the local climate and architectural style, and it is often built with natural materials such as stone or clay.	

The traditional house is a cultural representation, symbolic and social for the trilog (man/animal/reserve) (table 3). The domestic space is planned in an evolutionary fashion (Aksas, & Hamouda, 2023). Traditional houses in the Aurès region of Algeria (referred to as Theddarth in the local Chaoui language) are more than mere shelters. They are deeply rooted in a way of life shaped by climate, topography, and centuries of social and cultural practices. Each space within the home, from its entrance to the rooftop terrace, is defined by a distinct function and architectural expression. These elements together form an intelligent spatial system that prioritizes privacy, climate control, multifunctionality, and community values. Below is a detailed overview of the key spaces within the traditional Aurès house.

Table 3. The different spaces of the traditional Aurès house «Thaddarth».

Study case	Original name	Characteristics	Schemas and figures
Chicane Entrance The vestibule	-ThASQUIFT -THAARICH -Skiffa -Askift	-The skiffa is a rectangular space that loses its quality as a filtering space and becomes a transitional space (a mediating space). This space is designed, covered, and has play areas for children. -Askift: is a zigzag entrance designed to preserve the privacy of the group from external views.	
The living room	-Bit Edhiaf -Sala	-This space is used as a living area during the day and as a sleeping room at night. -To receive guests	
The Rooms The Bedroom	-El Biout -Bit -THABIOUT	Annex room: a multifunctional space used during the day, serving either as a living area or a storage room. Sleeping Space: Thabiout: primarily dedicated to nighttime functions such as rest and sleep.	
Storage Space	-Bit Ikhazin - Mekhwen	In Chaoui houses, dedicated storage rooms are often found in dry areas that also serve for drying goods. This arrangement can sometimes enhance thermal comfort, particularly through the creation of a chimney effect.	
The Kitchen	Thaderth niilmes	The Aurès kitchen is a multifunctional space, including: <ul style="list-style-type: none"> • A weaving area • A raf (traditional raised platform) • A cooking area Water skins (agueddih) are also found in this space. The hearth (fireplace) represents the heart of the Thaderth N'iilmés, where the family gathers.	
The courtyard	El Houche	The courtyard occupies approximately one quarter of the total surface area of the Theddarth. Around El Hauouche, the rooms, sanitary spaces, and livestock shelters are organized. This layout allows natural light to be distributed into the surrounding interior spaces.	
The restroom The toilet	Zerdab	The restroom is a room measuring 1.2 x 1.2 x 1.5 meters in height. It has no doors, but only a free bar with dimensions 0.6 x 1.2 meters in height, located in the opposite corner from the toilet.	
The Sunny terrace	Thassemmachth	The sunny terrace, rectangular in shape and facing the river, measures 2.5 meters in width, 3 meters in depth, and between 4 meters and 6 meters in length. It is primarily used for drying dates.	
The barn Stable	-Thafrekth -kouri -Zriba	The barn is a space designed for housing animals, such as goats or mules, and can also be used for storing agricultural equipment. It is equipped with a door specifically designed for animals.	

The Thaddarth is a term often used in the context of traditional or historical homes in regions such as the Aurès, North Africa. It refers to a type of rural or urban dwelling that can be characterized by specific interior features (figure 2), often designed for functionality and comfort in harsh climates. The interior layout generally reflects the culture, climate, and social customs of the people who build and inhabit these structures.

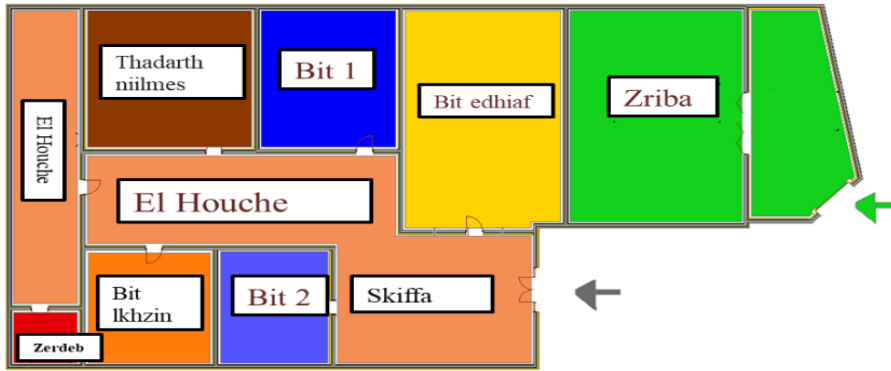


Figure 2. The different spaces of the traditional Aurès house «Thaddarth» (Developed by Author).

The Auresian society lived in a self-sufficient economy marked by resource scarcity. This context explains the predominant use of local materials in construction. The selection of these materials, combined with the region’s topography, results in a continuity of forms, natural tones, and a uniform aesthetic, enhancing the seamless integration of buildings into the landscape. The durability of the traditional dwellings in the Oued Abdi Valley is primarily due to the use of time-tested techniques and natural materials such as stone, wood (oak and ash), earth, straw, rammed earth, and clay (figure 3).

- **Clay:** Abundant and easily accessible, clay is one of the most frequently used construction materials. When mixed with straw and water, it forms the base for adobe bricks. It is used for:
 - Binding bricks and stones
 - Roofing layers
 - Floor coatings
 - Plastering walls

This use of clay is consistent with ancient and sustainable construction practices found across the Aures region.

- **Stone:** Stone is a weather-resistant material that helps extend the life of the building. It is primarily used for the foundations, enhancing the structural longevity. Stones that are carved and transported from distant locations are only used when absolutely necessary.
- **Wood:** Wood is plentiful in the region and sourced from nearby forests, orchards, or even salvaged from ruined buildings. It plays a crucial role in Auresian architecture, serving as:
 - Structural posts and beams
 - Roof framing
 - Tie beams and reinforcements
 - Lintels, doors, and windows

This intensive use of wood is historically rooted in the relationship between Auresian builders and their natural environment.



Figure 3. The various local building materials used in traditional Aurès houses.

The wall is constructed using a double row of large upright stones, with smaller stones tightly packed between them to ensure stability. It is divided into horizontal courses spaced approximately one meter apart. These layers are reinforced with wooden branches. Smaller branches, measuring around 5 x 50 cm, are laid transversely at regular intervals, while larger branches, approximately 15 x 250 cm, encircle the wall, providing additional structural cohesion and reinforcement.


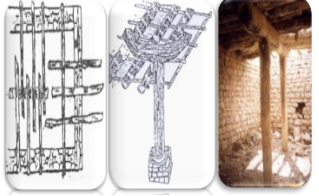


The floor structure is supported by two vertical posts known as Harselt, made from debarked trunks of juniper, Aleppo pine, cedar, or apricot tree. These posts are planted directly into the ground, spaced between 1.5 and 2.5 meters apart. At their top ends, a beveled wooden beam (at least 1 meter long) is embedded to serve as a support base.

Two rows of branches (typically of juniper, cedar, or Aleppo pine) act as joists, spanning from the lateral walls to the central wooden beam, forming the main support for the floor above.

A layer of dry, compacted earth is applied to the surface to prevent the formation of cracks and to ensure water tightness. The entire roof is further stabilized by a border of heavy flat stones, which helps keep it in place during strong winds or storms.

The dry earth layer is spread over a thick layer of earth mortar, which has been thoroughly beaten and mixed with cow dung, wood ash, and sap from local plants. This mixture is then systematically compacted until it forms a solid, waterproof surface, effectively sealing the roof from moisture.

Table 4. Construction Techniques.

Elements	Characteristics	Schemas and figures
The wall « Ifrak »	<ul style="list-style-type: none"> -The wall is constructed using a double row of large upright stones, with smaller stones tightly packed between them to ensure stability. It is divided into horizontal courses spaced approximately one meter apart. -These layers are reinforced with wooden branches. Smaller branches, measuring around 5 x 50 cm, are laid transversely at regular intervals, while larger branches, approximately 15 x 250 cm, encircle the wall, providing additional structural cohesion and reinforcement. 	
Structure/ Framework	<ul style="list-style-type: none"> -The floor structure is supported by two vertical posts known as “Harselt”, made from debarked trunks of juniper, Aleppo pine, cedar, or apricot tree. -These posts are planted directly into the ground, spaced between 1.5 and 2.5 meters apart. -At their top ends, a beveled wooden beam (at least 1 meter long) is embedded to serve as a support base. -Two rows of branches (typically of juniper, cedar, or Aleppo pine) act as joists, spanning from the lateral walls to the central wooden beam, forming the main support for the floor above. 	
Roofing/ Covering	<ul style="list-style-type: none"> -A layer of dry, compacted earth is applied to the surface to prevent the formation of cracks and to ensure water tightness. -The entire roof is further stabilized by a border of heavy flat stones, which helps keep it in place during strong winds or storms. -The dry earth layer is spread over a thick layer of earth mortar, which has been thoroughly beaten and mixed with cow dung, wood ash, and sap from local plants. -This mixture is then systematically compacted until it forms a solid, waterproof surface, effectively sealing the roof from moisture. 	
Finishing Coatings	<ul style="list-style-type: none"> -The exterior walls are left bare, preserving the natural appearance of dry-stone masonry. -On the interior, mortar is more extensively applied to the walls, serving as a base for a protective plaster made from clay, cow dung, and finely chopped straw (locally called then or loum). -This layer ensures basic protection and is further reinforced with a finishing coat made of white clay soil (temlilith), which smooths and consolidates the surface. -Plaster is also used for its hygrothermal properties: it absorbs moisture during winter and releases it in summer, contributing to interior comfort and climatic regulation. 	

4. Discussion

Syntactic analysis is a method rooted in space syntax theory, aimed at decoding spatial relationships within architectural layouts. By quantifying spatial connectivity and visibility, this approach enables a deeper understanding of how built environments influence social interactions, movement patterns, and environmental comfort. In the context of traditional Auresian dwellings, syntactic analysis provides valuable insight into how spatial configurations foster both functional coherence and environmental harmony, especially in a society characterized by self-sufficiency and resource-conscious design.

The interpretation of syntactic maps is based on core spatial concepts that serve as key parameters in this analytical method. Among them, integration describes how a space is connected to others. It is a static metric that reflects the average depth of a space relative to the entire system, indicating the degree to which a space is either integrated or segregated (Klarqvist, 1993).

In this study, Depthmap software was used to generate visual integration maps, with a color gradient ranging from blue (low integration values) to red (high integration values). Results from the Depthmap the visual integration analysis reveal a consistent spatial hierarchy in the traditional Auresian home (figure 4). The central courtyard (El Houche) consistently registers the highest integration values (surpassing 22.00) making it the most accessible and visually dominant space in each case study. In contrast, private or peripheral rooms display much lower integration values (typically ≤ 6.00), indicating spatial segregation and privacy.

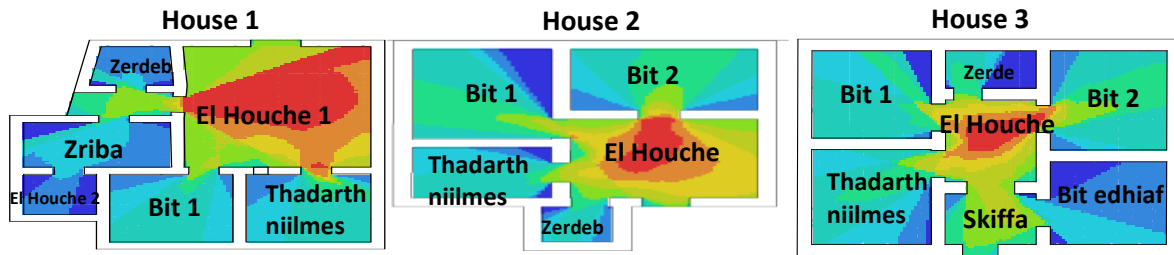


Figure 4. The results of the Visibility Graph Analysis (VGA) for measuring visual integration (Developed by Author).

Furthermore, we analyzed the isovist field, defined as the total area visible from a specific vantage point. For each case, a point located in the most integrated space was selected, simulating a 360-degree visual field to assess visibility throughout the dwelling (figure 5).

The isovist-based visibility analysis further enhances this understanding. The courtyard stands out not only in its centrality, but also in its visual openness and spaciousness—attributes derived from high isovist area, perimeter, and occlusivity. These characteristics suggest a high degree of spatial awareness and comfort for occupants in the courtyard, reinforcing its role as the social and functional heart of the dwelling.

The comparison across the three house typologies illustrates the following:

- House 1 demonstrates the most expansive visual field, with the largest isovist area and perimeter, a relatively low occlusivity value (22.07 m), and the highest compactness score (0.23). These features suggest a well-balanced and efficient visual structure, offering both openness and visual coherence.
- House 2 displays moderate visibility, with an isovist pattern resembling a circular field, indicating a balanced but less extensive field of view. This suggests a more intimate spatial experience, possibly designed to mediate between openness and enclosure.
- House 3 presents the highest occlusivity (28.45 m), which implies significant visual barriers within the space. While this enhances privacy, it also leads to a lower compactness (0.14), suggesting a more fragmented spatial structure that may compromise visual clarity.

Overall, the results underscore the functional and symbolic centrality of the courtyard in traditional Auresian homes—not just as a circulation hub, but as a spatial anchor that enhances visual access, light distribution, and thermal regulation.

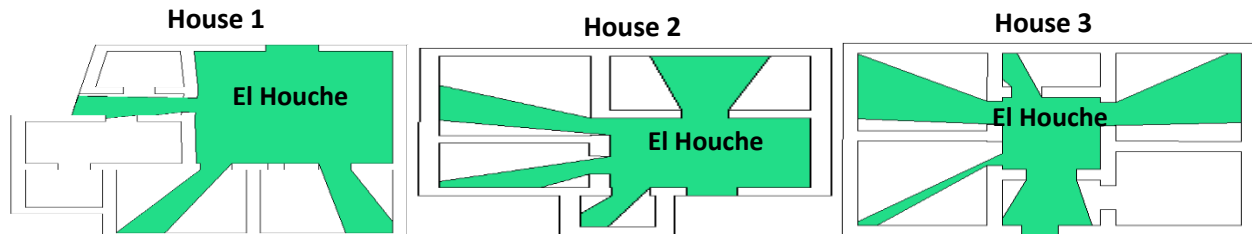


Figure 5. The results of the isovist analysis obtained using a 360-degree field of view (Developed by Author).

5. Conclusion

The threshold and entrance features in Aurassian homes embody more than architectural utility, they are deeply rooted in cultural symbolism and social norms. The dual-access system, the protective orientation of the door, and the family-specific engravings on the Thaborth all speak to a sophisticated understanding of space, identity, and community. These elements demonstrate how vernacular architecture can serve both practical needs and act as a medium for expressing collective memory and cultural continuity.

The architectural treatment of façades in traditional Aurès homes illustrates a refined balance between form and function, aesthetics and necessity. From the robust subbasement (wall base) that anchors and protects the structure, to the precisely carved Rouzna that breathe life and light into the interior, every element is a testament to centuries of local knowledge and adaptation. The chimney, though understated, completes this environmental dialogue, ensuring comfort and habitability throughout the seasons. Together, these features highlight an architectural tradition that is not only resilient and efficient, but also deeply expressive of the cultural identity and environmental intelligence of the Aurès people.

The architecture of the traditional Aurès house exemplifies a harmonious integration of form, function, and cultural identity. Each space (from the zigzag entrance to the sunny terrace) is thoughtfully conceived to meet environmental, social, and practical needs. Through multifunctional rooms, strategic ventilation, and spatial hierarchy, these homes serve not only as shelters but as reflections of the resilience, adaptability, and values of the Chaoui people. Their continued study offers valuable lessons in sustainable, community-oriented architecture rooted in local tradition.

The materials used in the construction of traditional Aurèsian homes are a testament to the region's resourcefulness and sustainable building practices. By making use of locally available materials such as clay, stone, and wood, the inhabitants of the Aurès region have developed a building tradition that is both practical and environmentally harmonious. These materials, each with its own specific function, contribute to the longevity, efficiency, and

aesthetic unity of the buildings, ensuring that they are well-suited to the local climate and terrain. Furthermore, these materials play a critical role in maintaining the cultural identity of the Aurèsian people, reflecting their connection to the land and the deep knowledge passed down through generations.

The continued use of these materials, despite the passage of time and external influences, highlights the enduring relevance of traditional architecture in the face of modernity. The sustainable practices embedded in Aurèsian construction offer valuable insights into how contemporary architecture might address issues of resource scarcity, climate adaptation, and cultural preservation in a rapidly changing world.

The syntactic and isovist analyses jointly reveal that the central courtyard (El Houche) functions as a highly integrated and visually privileged space within the traditional Auresian dwelling. Its spatial dominance supports communal life, climate adaptability, and architectural coherence. Meanwhile, the more segregated interior rooms reflect a nuanced balance between privacy and accessibility, reinforcing the home's sociocultural logic.

These findings highlight how traditional spatial organization (grounded in local culture, material availability, and environmental constraints) results in a built form that is both functionally efficient and sensitively attuned to human needs. As such, syntactic analysis not only uncovers the architectural intelligence embedded in vernacular design but also offers meaningful insights for sustainable architecture in similar contexts today.

While this study provides valuable insights into the traditional architecture of the Aurès region, there are several limitations that must be acknowledged:

- **Scope of Case Studies:** The study focused on a limited number of case studies, which may not fully represent the diversity of traditional Aurèsian dwellings. The spatial configurations and materials analyzed may vary across different sub-regions of the Aurès, and a broader selection could provide a more comprehensive understanding of the architectural practices.
- **Technological Constraints:** The use of syntactic analysis and visibility graph analysis, while effective, is based on available data from the physical site and floor plans. Variations in architectural modifications or external influences on the dwellings may not be captured fully, especially in cases where modern renovations or alterations have been made to traditional structures.
- **Cultural Interpretation:** While the study takes into account socio-cultural factors that influence architectural design, interpreting cultural symbolism and social practices can be subjective. Some cultural meanings might have been underrepresented or misinterpreted due to the complexity and evolving nature of cultural practices over time.
- **Climate Considerations:** The study primarily examines spatial and social factors, with less emphasis on how climate adaptation strategies evolve over time. The climate of the region is highly variable, and ongoing changes in global and local climate conditions could alter how these traditional structures are perceived and utilized in the future.

Future research on Aurèsian architecture and its socio-cultural implications can expand upon this study by exploring the following areas:

- **Broader Geographical Scope:** Expanding the study to include more settlements from different regions within the Aurès would provide a broader understanding of the architectural diversity within the region. This could help identify additional influences or variations in the spatial and social configurations of homes.
- **Longitudinal Studies:** Conducting longitudinal studies to track how traditional homes evolve over time, particularly with regard to climate changes, socio-economic shifts, and modernization efforts, would help understand the adaptability of traditional architecture.
- **Interdisciplinary Collaboration:** Collaboration with historians, anthropologists, and environmental scientists would help further contextualize the role of cultural traditions, rituals, and environmental factors in shaping architectural practices. This could provide a deeper understanding of the broader societal values that influence design choices.
- **Technological Integration:** Investigating how modern technology, including advanced climate control and building materials, can be integrated with traditional techniques could offer new sustainable solutions.
- **Focus on Urbanization and Revitalization:** Research could further examine the process of urbanization and the revitalization of traditional architecture, focusing on how urban renewal projects have affected the preservation of cultural heritage. How have government policies influenced the integration of traditional architecture in urban planning, and what are the long-term impacts on community cohesion and social structure?

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Conflict of Interests

The Author(s) declare(s) that there is no conflict of interest.

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