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Effectiveness and Performance of Spatial Communication within Composite Interior Space: The Wayfinding System in the Saudi National Museum as a Case Study

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***Abstract*—**The wayfinding system affects the course of a museum journey for visitors, both directly and indirectly. The design aspects of this system play an important role, making it an effective communication system within the museum space. However, translating the concepts that pertain to its design, and which are based on integration and connectivity in museum space design, such as intelligibility, lacks customization in the form of specific design considerations with reference to the most important approaches. These approaches link the organizational and practical aspects to the semiotic and semantic aspects related to the space syntax by targeting the visual and perceived consistency of visitors. In this context, the present study aims to identify how to apply the concept of intelligibility by employing integration and connectivity to design a wayfinding system in museums as a kind of composite interior space. Using the available plans and images to extrapolate the considerations used to design the wayfinding system in the Saudi National Museum as a case study, a descriptive analytical method was used to understand the basic organizational and Morphological principles of the museum space through the main aspects of space design (the Morphological and the pragmatic). The study's methodology is based on the description and analysis of the basic organizational and Morphological principles of the museum space at the level of the major Morphological and Pragmatic design layers (based on available pictures and diagrams) and inductive method about applied level of intelligibility in spatial layout in the Hall of Islam and Arabia at the National Museum Saudi Arabia within the framework of a case study through the levels of verification of the properties of the concepts of connectivity and integration. The results indicated that the application of the characteristics of intelligibility is weak on both Pragmatic and Morphological levels. Based on the concept of connective and integration, we conclude the following: (1) High level of reflection of the properties of connectivity on the pragmatic level, (2) Weak level of reflection of the properties of Connectivity at the morphological level (3) Weakness in the level of reflection of the properties of integration in the space sample as a result of a weakness in the application at the morphological and pragmatic level. The study's findings will assist designers, professionals, and researchers in the field of museum design in understanding the significance of the wayfinding system by delving into it through museum spaces by highlighting the most essential aspects using a clear analytical method.

***Keywords*—**Wayfinding system, museum journey, intelligibility, integration, connectivity, interior design.

I. Introduction

THE wayfinding system aims to determine a route in complex environments. It is generally based on facilitating the visitor's interaction with the museum environment in a positive framework that supports mobility and enhances the enjoyment of the journey through the museum space [1].

In this context, the wayfinding system plays an important role in enhancing the visitor's experience during their museum journey. The efficiency of the wayfinding system is based on its effectiveness and its configuration to make the visitor's movements clear regarding their destination [2].

Here, the concept of "clear destination" is manifested through the mechanism of organizing spatial planning and communication space with the external and internal zones [3], especially if we consider the importance of spatial planning and the wayfinding system in achieving efficiency in navigation and guidance [4].

In this context, some researchers [5] clarified the importance of spatial analysis related to the field of human-centered architectural design, which still requires future studies to this day regarding the link between the wayfinding system and the spatial circulation system.

In principle, the link between the wayfinding system and the spatial circulation system is based on several design considerations that require targeting the visitor's awareness through the design of the building as a whole. This is achieved by adopting the formation of the linguistics of the museum space in general and designing the wayfinding system in particular as an important part that plays an active role in attracting the visitor's attention and urging them to effectively engage in the museum experience.

The concept of forming a space syntax is important when thinking about space design or focusing on the organization of spaces, movement patterns, and their social meanings [6]. The formation of space syntax has been defined as a concept that expresses a social or cultural meaning that enhances user

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interaction in built environments [7].

In this context, it may become necessary to address the concepts related to the planning processes for complex interior spaces (the circulation system, the formation of the space syntax, and so on) in a manner that enables access to a set of deep meanings related to the design of the wayfinding system. This is because these meanings often reflect a number of important design considerations that would, when taken into account, enable the designer to design an effective wayfinding system that performs its function by adopting symbols and visual, aesthetic, and functional formations to support the visitor's museum journey.

From this perspective, this study aims to do the following:

Identify the level of application (the concept of intelligibility) by employing the two concepts (connectivity and integration) to design the wayfinding system in museums as a kind of complex interior space.

The question of the study relates to how the design characteristics of the wayfinding system (intelligibility, connectivity, integration) are reflected in the design of the museum space as a complex space.

II. Wayfinding System

The wayfinding system is an effective system that facilitates the movement of visitors and allows them to enjoy their experience without focusing on time in finding the next point [8].

Reference [9] defined the wayfinding system in its use aspect as a dynamic process that depends on how people think and behave when navigating in relation to the surrounding environment. He explained that this process depends in its conclusion on the decision-making of the user, which can be affected by cognitive burdens, emotions, and personal experience.

Reference [10], on the other hand, defined the wayfinding system as a decision-making process and explained that it is essentially based on a complex process of perception.

Reference [9] also indicated that the psychology of the wayfinding system, including such aspects as the process of finding a specific site and deciding which way to go, is to search for information through the perceptual process of our senses and is also based on the memory of the road on the basis of experience.

From another angle, [11] explained that the process of perceiving the wayfinding system involves planning to achieve directed mobility that depends on sensory movement and its interaction with the environment.

Reference [12] indicated that the exact meaning of the wayfinding system is the process of navigation that depends on the awareness of the user by focusing on spatial models' clarity of awareness.

Reference [13] explained that mobility is a distinctive feature of the wayfinding system as an activity based on planning and designing environmental communications by a combination of internal knowledge and external information to determine users' behavior.

In order for the vision to become clear, the concepts of the wayfinding system and what they refer to need to be identified in addition to achieving an impact on the perception of the museum journey through the formation of the space syntax.

Reference [14] clarified that the basic elements for the formation, use, and perception of space are the organization of space, the organization of social relations, and the organization of cultural content. Therefore, the formation of relationships through the organization of these layers, and how these layers convey meaning, and the design is built in relation to the manipulation of space and form.

A. Design Process Context and Wayfinding System

1. The Importance of the Wayfinding System in Targeting the User's Communication with the Environment

With regard to the design aspect of the wayfinding system, [9] described how designers should focus their studies on user requirements to develop wayfinding system characteristics in proportion to them.

Reference [15] considered the wayfinding system as an orientation system for visitors; by trying to identify visitors' expectations and experiences, he examined how to interpret the information of the current experience. He added that it is necessary to provide visitors with sufficient and accurate information about what is going on around them; this guidance includes the topics of exhibitions, programs, activities, and time.

Based on this, [14] saw that orientation is a determining factor in the user's ability to identify and communicate with the environment in the spatial, cognitive, and linguistic worlds so that the user's position within a spatial system with a unified pattern of human activity in the environment becomes apparent.

To clarify this, [14] stated that navigation requires direct visual access through strategically placed information and its representation with figurative semantics.

According to that vision, [14] clarified that any signs in the environment for navigation are considered a mediator between the space and the visitor, are known as the cognitive dimension and represent a description or symbol.

2. The Importance of Targeting Orientation Through Spatial Circulation

Reference [16] emphasized the importance of looking at the relationship between orientation and spatial circulation because they are closely related and have properties that affect one over the other.

Reference [17] suggested that the spatial circulation is an attractive force that moves users in their paths or changes those paths and communicates with public spaces to reach a satisfactory experience.

Reference [5] defined the effective spatial circulation system as a system that links human behavior and spatial determinants.

In light of this, [18] defined spatial circulation as the space that connects spaces. It has several components:

1) The approach to the building
2) The building entrance
3) The configuration of the path
4) Path–space relationships

5) The form of the circulation space

Reference [19] stated that the concept of the spatial circulation system is the main factor for determining the clarity of the wayfinding system based on evaluations of the building plan, the organization of movement through the linguistics of space, and the classification analysis of spatial circulation types.

Accordingly, [20] stated that the clarification of spatial circulation types is done by means of boundary graphing and complexity abstraction.

Reference [19] indicated that the environments are based on the spatial knowledge sequence by tracing landmarks, routes, and configurations.

In light of this, [5] mentioned that understanding the relationship between spatial configurations and the formation of the mental image helps in movement, circulation, and layout to achieve the desired.

III. Representation and Evaluation of Spatial Complexity

Reference [12] stated that space syntax theory describes the logic of society through its manifestations in spatial systems and how spaces are put together in addition to its direct relationship to how the user perceives, moves, and uses many types of spatial systems, from small local spaces to big cities. It is important to note the conceptual (non-functional, cognitive–behavioral) properties of space syntax theory.

Reference [21] stated that linking space syntax to cognitive science by analyzing the clarity of spatial circulation types indicates that spatial composition has an effect on some aspects of human activity in terms of spatial perception and movement behavior so that navigation is easier.

Reference [22] clarified that spatial knowledge is related to two components of space, namely, the reading environment (that is, the place that can be organized in a coherent and recognizable form and pattern) and the ability of the space to form a mental image, which is known as intelligibility.

As emphasized by [20], the theory of space syntax established the property of intelligibility to implement graph techniques and to represent the layouts of buildings and compare them by calculating the scales of the graph; this is called morphology.

Reference [5] defined intelligibility as measuring the ease of navigation using analytical tools (axial graph analysis and visibility graph analysis) for the spatial organization of the building, summarized in graphics based on the architectural design and usable.

Reference [26] pointed out that intelligibility can be measured through the spatial layout variable, which depends on the formation of a mental image.

Reference [23] added the possibility of measuring intelligibility by studying the properties of space that help in the design.

Reference [5] defined a connectivity where a local property is represented for each element in the graph. Reference [24] added the connectivity feature, which captures the number of destinations that can be seen from each axial line within the given geometric planning conditions.

Reference [5] indicated that connectivity is a feature that counts the number of nodes or network points that are connected to each other. It captures the number of destinations that can be seen from each network point.

In view of these properties, it was recognized by [25] that integration is a basic concept in spatial planning but that the actual meanings relate to the various planning processes and the processes of spatial development.

Reference [26] suggested that spatial integration is the physical and functional integration between domains. Spatial integration expresses the level of interaction within and between regions as a measure of the levels of communication between transport elements.

For [27], integration is a universal measure and is seen as a comprehensive relationship between a point and the system as a whole. It is achieved by measuring the number of steps required to reach every other point in the chart within the graph.

In his opinion, if there is not one site that is directly visible from another place, but it is visible through a third site, we say that it is indirectly visible, that is, through an intermediate site, and thus the relative importance of integration can be determined.

Reference [28] explained the complex spatial integration meaning of four dimensions: the physical dimension, the functional dimension, the relational dimension, and the symbolic dimension.

Reference [29] showed that integration has multiple linkages in spatial planning and, therefore, partially overlaps in terms of semantics, focusing on spatial scales for integration (vertical) and neighboring regions for integration (horizontal).

Reference [5] indicated that the most integrated places are the visual accessibility in general to a point within the graph through short distances of vision.

Based on this, [20] argued that integration expresses the possibility of seeing directly and indirectly from the site, whereas connectivity sees directly from one site. It also showed that intelligibility is highly accurate in predicting motion and added that intelligibility is calculated as a relationship between the two values of connectivity and integration.

IV. Methods

The study was conducted in the city of Riyadh, Saudi Arabia in 2021 and relied on descriptive analytical and inductive methods.

The description method was used in presenting the literature to construct concepts related to the wayfinding system design (intelligibility, connectivity, and integration) in addition to describing the basic organizational and Morphological principles of the museum space through a case study of the Hall of Islam and Arabia in the Saudi National Museum in Riyadh. This was done at the level of major Pragmatic and Morphological layers in the design of the space (based on available pictures and diagrams).

In addition, the analysis method was used to extract the most important design considerations of the composite space at the Pragmatic and Morphological levels as basic levels of spatial

layout through a case study.

Then, the inductive method relating to the applied level of connectivity, integration, and, consequently, the concept of intelligibility was extrapolated in the wayfinding system in the specified space, and the data was collected through field visits and virtual visits through the museum's website (National Museum Virtual Tour).

A. Data Collection Procedures

1. Case Selection

The case study concerns the Saudi National Museum in Riyadh, one of the most prominent archaeological and tourist attractions in the Kingdom of Saudi Arabia. The museum is located on the eastern side of the King Abdulaziz Historical Center. The museum opened during the reign of King Fahd bin Abdulaziz Al Saud in 1999 and was designed by architect Raymond Moriyama [30].

We contacted the museum administrators and explained the purpose of the study, emphasizing the confidentiality of the information and that it would only be used for scientific research.

Fig. 1 The main entrance of the Islam and the Arabian Peninsula Hall [30]

2. Case Selection Criteria

The following criteria were used to select the hall within the Saudi National Museum:

1) It is a composite space located on the first floor of the museum
2) It includes more than one type of circulation
3) It includes more than one wing (4–6)
4) The path relates to a topic that is divided into historically successive periods and axes that are reflected within multiple wings and landmarks
5) The space area does not exceed 1,200 square meters

3. Case Description

The Hall of Islam and Arabia (Fig. 1) was selected as the case study. It is the fifth hall in terms of arrangement, with an area of 1,200 square meters, and is located on the first floor.

The hall includes six wings (Fig. 2): Islam and the eras of the caliphate in the Arabian Peninsula, beginning with the arrival of the Messenger (may God bless him and grant him peace) an immigrant to Medina, the Umayyad and Abbasid eras, and a presentation of the industries of Muslims for these periods.

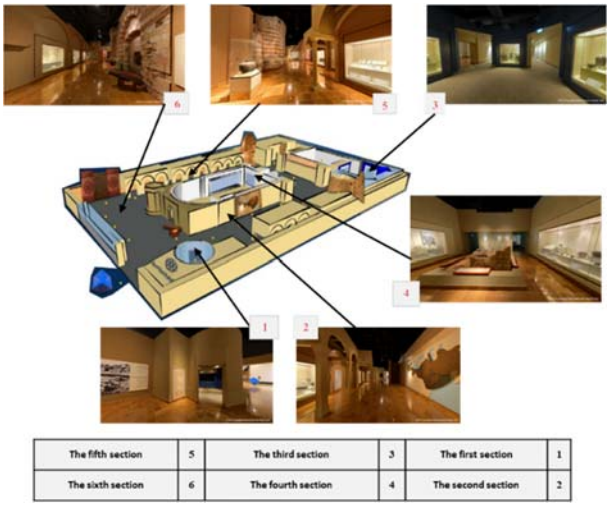


Fig. 2 Case description (Islamic and Arabian Peninsula Hall Sections) [30]

4. Data Analysis

There were several stages to achieving the study objective of identifying to what extent the concept of intelligibility can be applied by employing the concepts of integration and connectivity to designing the wayfinding systems in museums as a kind of composite interior space.

The first stage was to define a set of concepts for wayfinding system design (intelligibility, integration, and connectivity) by means of a literature review. The primary bases of analysis are identified and categorized in (Table I).

In the second stage, the museum space (the hall) was described using [31] as a reference for the levels of analysis of the composition of the space (both Morphological and pragmatic) and its use according to the context of this study (Table II).

In the third stage, the basic organizational and structural principles of the museum space (the hall) were analyzed according to the theoretical framework and [31] for the levels of analysis of the composition of the space and its use according to the context of this study. This stage involved the following steps:

1) Designing a table (Table III) that could analyze the space specified for use in the study according to the concepts of intelligibility, integration, and connectivity and within the framework of identifying the foundations of spatial planning for the wayfinding system.
2) Designing separate preliminary tables that could identify the extent to which the concepts of integration and connectivity can be applied at Pragmatic and Morphological levels. This involved the following steps:

Step one, in order to extract these levels, "data availability" is encoded with a **green** circle and is equal to "1", while "unavailability" is encoded with a **red** circle and is equal to "0" (Tables IV and VI).

Step two, determine the value of the application of **integration** and **connectivity** features separately, on two

levels:

1) **At the Pragmatic level** (by summing up the number of properties available for each component of the spatial circulation [18]. These components are comprised of: (1. The building approach; 2. The building entrance; 3. The configuration of the path; 4. Any path–space relationships; 5. The form of the circulation space).
2) **At the Morphological level** (layout), through a study of both navigation (i.e., appropriate amounts of information placed strategically in verbal or pictorial semantics) and orientation (i.e., a spatial system with a unified pattern) according to [13].

Step three, determine the final value of the level to which the properties of the concepts of integration or intelligibility can be applied at the Pragmatic and Morphological level by aggregating the sum of the values (numbers) obtained within the framework of each level and according to the characteristics of each concept (Tables V and VII)

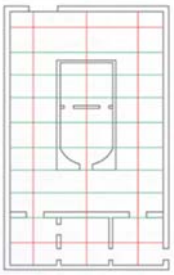
TABLE I
CONCEPTUAL DEVELOPMENT AND THEORETICAL FRAMEWORK

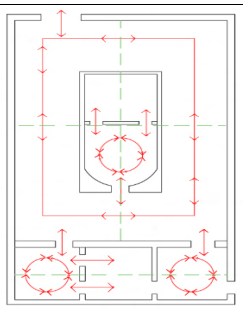
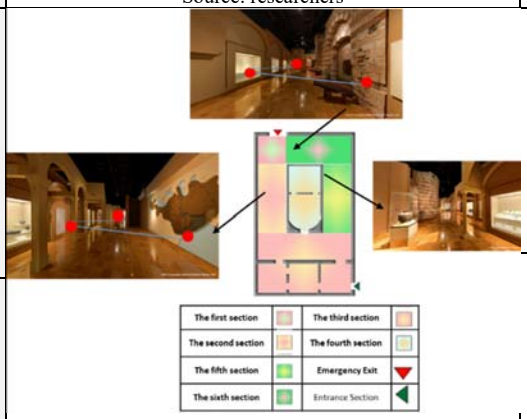
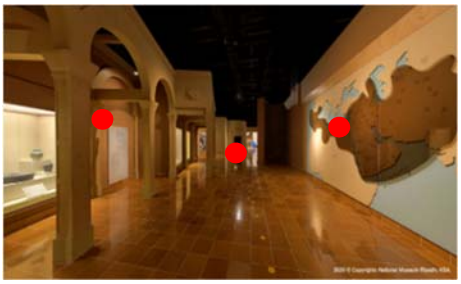
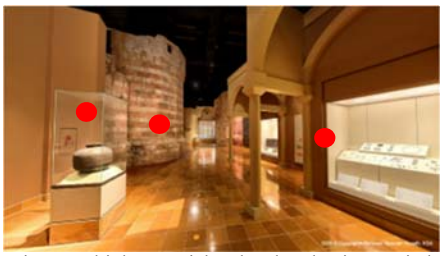
Concept	In the context of the relationship between the wayfinding system and the museum journey	In the context of the relationship between the wayfinding system and the composite interior space	The characteristics of the study
Connectivity		The user's ability to communicate with the environment within a spatial system, with a unified pattern of human activity in the environment [5]	**One spatial pattern system**
	A local property of each element is represented in the graph [5]	A force of attraction that can move the user in his path, causing him to change direction or to communicate with public spaces in order to reach a satisfactory experience [17]	**The number of nodes or points on the grid**
		Connecting spatial spaces with the spatial circulation [18]	**Spatial spaces with spatial circulation**
Integration	It captures the number of destinations that can be seen from each axial line under the given geometric planning conditions [5]	A local property of each element is represented in the graph [5]	**Number of destinations on the axial graph**
	The property has a complex meaning that appears in four dimensions: the physical dimension, the functional dimension, the relational dimension, and the symbolic dimension [23]		**Symbolic dimension** **Physical dimension** **Functional dimension** **Relational dimension**
		An essential property of spatial planning [25]	**Layout type**
		A property expresses the level of interaction within and between the zones as a measure of the levels of communication between transport elements and between the physical and functional domain [26]	**Transport elements (physical and functional)**
	A property that is considered a global scale, which considers a comprehensive relationship between a point and the system as a whole, as it measures the number of steps required to reach every other point in the chart within the graph. The relative importance of the characteristic can be determined either directly and visually or indirectly and visually [27]		**Indirect view of another site**
			Direct view of another site
Intelligibility		Intelligibility is a measurement tool showing ease of navigation through the use of analytical tools (axial analysis or graph analysis) that demonstrate the building's spatial organization. It is summarized in graphs that focus on architectural design and usability [5]	**Connectivity**
		The space–syntax theory property was established in order to implement graphical techniques that can represent and compare building layouts. These are called morphology computation–graph scales [20]	**Connectivity**
	Navigation through strategically placed information and its representation with figurative semantics [13]		**Integration**
	The spatial circulation system is the main factor in determining the properties of a wayfinding system [19]		**Integration**
	The possibility of measuring the property by studying the properties of the space that have influenced the design of the area [24]		**Integration**

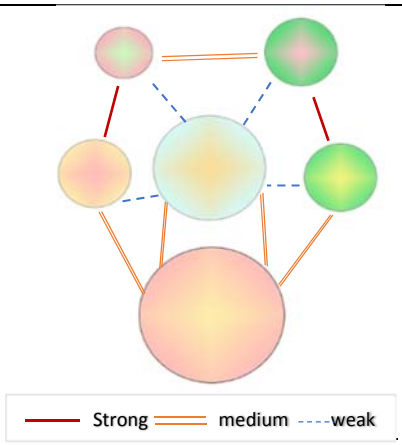
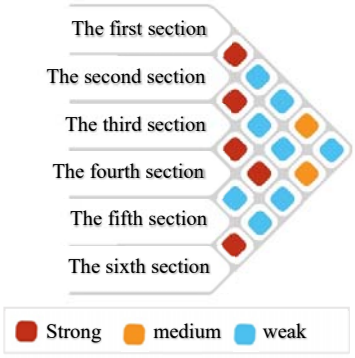
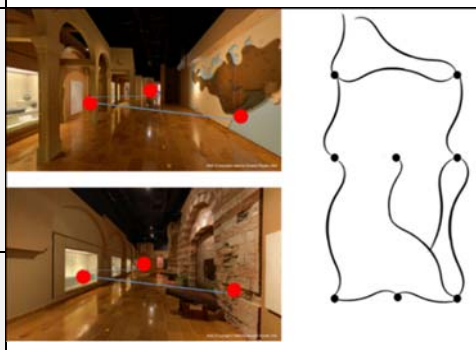
TABLE II
DESCRIPTION OF A SAMPLE SPACE AT A GRAPH GRAPHIC AND PRAGMATIC LEVEL

Sections	Morphological (layout)	Pragmatic (circulation)
First section	The first section begins with a landmark that consists of a brief introduction to the Arabian Peninsula and Islam, and continues in a linear distribution that progresses through all the exhibits.	The era of early Islam is displayed in wall panels located on both sides. The section ends with exhibits from the Qur'an collection displayed in a linear path on the main axis that is open on both sides.
Second section	The section begins with a map of the spread of Islam in the era of the Umayyad Caliphate. It continues on one side with a linear distribution of exhibits from the Umayyad era. At the end of the path are prominent structural details regarding the Mosque of Omar Ibn Al-Khattab, may God be pleased with him.	It displays the era of the Umayyad Caliphate on both sides of the main axial linear path and ends with a landmark and a sign directing users to the next section.
Third section	The section begins without signage, as there is a landmark that provides an overview of what is going on inside. The section consists of three successive rooms in a radial distribution, closed by an external entrance. The first contains exhibits of some industries in which Muslims have excelled and the tools they used. With an internal entrance into the second room, a movie is shown about Arab sciences and their spread and superiority over others during that era. The third room, which has a separate external entrance offering access to the exhibits, includes examples of Islamic calligraphy inscribed on stones of different sizes that have been taken from important sites from Islamic times.	In the exhibition halls, famous Muslim items are displayed in a radial path as a sub-axis.
Fourth section	The fourth section begins with a front entrance that serves as a landmark outside the room; this includes items used in the kingdom during that time. This section consists of two closed radiological distribution rooms: the first contains items from and information about some of the most important Islamic sites in the Kingdom of Saudi Arabia, while the second has two internal entrances that lead to showings of a film that imagines what life was like in Islamic times.	There are many items displayed in the two rooms. Several of the most important Islamic sites from the Kingdom of Saudi Arabia are covered in this section; these are displayed outside the hall's main axis. Inside the hall is a radial path.
Fifth section	The fifth section begins with a landmark that includes an overview of the Abbasid era and a detailed structural wall from the palaces of Medina from the Umayyad and Abbasid eras. The distribution of the exhibits on the main axis on the other side of the hall begins with a map showing the spread of Islam in the era of the Abbasid Caliphate. A linear distribution on both sides features exhibits relating to the Abbasid State.	This section displays the Abbasid Caliphate era on both sides of the main axial linear path.
Sixth section	The sixth section begins with a landmark that includes an overview of the Ottoman era and a detailed structural facade of an Ottoman prince's palace. The linear distribution continues within the main axis, which contains exhibits from the Ottoman period and wall signs; on the other side of the axis are cannons and parts of an Ottoman sultan's castle.	This section displays the Abbasid Caliphate era on both sides of the main axial linear path. The path ends with the exit gate leading out of the hall.

TABLE III
SPATIAL PLANNING ANALYSIS FOR THE CASE STUDY

Concept Properties		Analysis	
One spatial pattern system	**Connectivity**	 Fig. 3 Spatial system analysis (via axial graph) Source: researchers	• There is a regular geometric system at the level of the spaces. • The network is based on a scale that is 1/6 of the width and approximately 1/10 of the length of the original. • The linear circulation distribution of areas is determined according to the historical data.
Layout type	**Integration**		• The regular radial linear network for the circulation with the axial line of the network.

			• Spatial distribution with historical logic on the plan grid.
Spatial spaces with circulation	**Connectivity**	 Fig. 4 Circulation diagram Source: researchers	• A linear-motion path with a grid axial for the open space and a radial axial for the closed space. • The circulation path is open on both sides. • Spatial spaces sit in a logical historical distribution with an axial movement path.
The number of destinations on the axial line	**Connectivity**	 Fig. 5 Zoning plan Source: researchers	• There is a destination at the center of the network's axial line and five destinations distributed around the axial line. • The motion path is linear for the four destinations; two destinations, with a radial path leading to the closed destinations. • There is a logical distribution of destinations and a pivot line.
Vertical and horizontal transmission elements (physical–functional)	**Intelligibility**		There is an absence of transmission elements, as shown in the functional distribution of the hall.
Symbolic dimension	**Intelligibility**	 Fig. 6 The symbolism between the spaces according to the historical period Source: [30]	• Each destination symbolizes a historical period. • There is a movement path that follows the historical symbol of the period. • The symbolic distribution of space for the time period.
Physical dimension	**Intelligibility**	 Fig. 7 Multiple materials related to the time period Source: [30]	• The materials used in this section fit the theme of the hall. • There is a radial movement track with an ancient historical character. • The distribution of spatial spaces contains the physical characteristics of the period.

Functional dimension	**Intelligibility**	 Fig. 8 Bubble diagram Source: Researchers	• The sizes of the six circles vary according to the area they represent and the functional relationship between the areas. • The radial circulation on both sides of the spaces is easily accessible. • The zones are distributed both chronologically and functionally.
Relational dimension	**Intelligibility**	 Fig. 9 Matrix diagram Source: Researchers	• There is a strong relationship between the chronologically close zones. • The path serves the adjacent area. • The distribution of the regions varies according to the time period. • There is a spatial distribution with historical logic on the grid.
The number of nodes, or points on a grid	**Connectivity**	 Fig. 10 Corresponding boundary graph Source: [20]	• There are eight nodes that serve as points on the grid level; these are defined by specifying the number of destinations. • The relationship between the two circulation nodes is linear. • The distribution of nodes is historically sequential from entrance to exit.
Direct view of another site	**Integration**		• There are eight nodes that serve as points on the grid level that are defined by specifying the number of destinations; as such, every two nodes with a link are directly visible. • The relationship between the two circulation nodes is linear and in direct view. • The distribution of nodes is sequential (from the entrance to the exit) and in a direct visual manner for each two nodes.
Indirect view of another site			• The path serves the third area, which is close to the path itself and is indirectly (but not clearly) visible. • The distribution of the regions varies according to the period; therefore, users are provided with an indirect (but unclear) view of their destination.

Step four, Extrapolation of the application level of Intelligibility properties (high, medium, weak) by adopting the collection rate of the number of applied elements according to the properties of both concepts: integration, and connectivity at both the Pragmatic and Morphological levels. A scale was created to extract these levels according to the following considerations (Table VIII).

V. Results and Discussion

When identifying the levels of application of the concept of intelligibility by employing the concepts of integration and connectivity to design the wayfinding system in museums as a kind of composite interior space, the results indicated that the level of application is generally weak, as only 39 properties out of a total of 84 showed that intelligibility was applied at both the Morphological (10 out of a total of 24 characteristics) and Pragmatic (29 out of a total of 60 characteristics) levels, (see Table IX).

The results also indicated that there is a high level of realization in regards to the properties of the concept of **connectivity** in the space sample at the Pragmatic level compared to the level of realization of the properties of the concept of **integration**. This is, perhaps, mostly due to the clarity of the pivotal line through the architectural design of the spatial organization of the hall and the sequence of nodes found on the hall's spatial network, as well as its usability.

It was also concluded that the value is weak compared to the strength of the realization of the properties of both concepts (connectivity and integration) at the Morphological level. This is, perhaps, due to the lack of semantics and verbal and pictorial information in the hall, which would otherwise facilitate the process of navigating in the space.

The results (see Table X) indicated that the level of reflection relating to the properties of **connectivity** in the space sample is high: 17 properties were applied out of a total of 28 at the Pragmatic level (where 14 properties were applied out of a total of 20), despite the weakness of the application at the Morphological level (where only three out of eight properties were applied), see Table IV.

Additionally, the results (see Table X) indicated that three properties of the **intelligibility** concept were achieved in the spatial circulation in the hall. This was achieved through a high application of properties at the Pragmatic level, which reached 14 properties out of a total of 20 for each of the following elements:

1) The building entrance
2) The form of the circulation space
3) The path–space relationship

In comparison, the percentage of application of **connectivity** properties was average at the level of the building approach and the configuration of the path. Two characteristics were achieved in terms of spatial diversity, resulting in a difference in the spatial circulation types within the space.

The results related to the Morphological level showed a weak level of application (see Table X), as only three properties were applied out of eight, as follows:

1) Navigation: Only one of the four properties was achieved, due to a lack of indications and information in the spatial planning.
2) Orientation: two of the four properties related to the multiplicity of spatial patterns in the hall (linear–radial) are achieved.

The level of reflection regarding the properties of **integration** in the space sample was shown to be generally weak, as 27 properties were applied out of a total of 56 for both Morphological (where 7 out of a total of 16 characteristics were applied) and Pragmatic (where 20 out of a total of 16 characteristics were applied) levels.

The results (see Table X) indicated that the level of application of properties was generally average at the Pragmatic level; the application of 20 out of 40 properties essentially achieved five out of eight properties for each of the following points:

1) The building approach
2) The building entrance
3) The path–space relationship

However, the configuration of the path was only weakly validated. This is due to the realization of only three out of eight properties related to the historical and functional relationship between spaces, which results in the achievement of the indirect vision property. Achieving this property requires a difference in the circulation type within the space. The form of the circulation space was poorly validated, scoring only two out of eight points related to planning and accordingly, only historically correlated spaces.

At a Morphological level, the results (see Table X) indicated only a weak level of application, as seven properties were applied out of a total of 16. Here, the level of application for navigation properties was average (4 out of 8 properties), while the level for orientation requirements was weak (3 out of 8 properties). This is, perhaps, due to the emergence of the characteristic of direct visual vision, which is necessary when analyzing the relationships between the wings in terms of the functional dimension of the hall at the planning level.

VI. Conclusion

The concept of intelligibility is a key factor in understanding the relationships between concepts involved in the configuration of space (especially in spatial planning) as it is able to show the style and accessibility of the destination. Intelligibility is expressed in space syntax (layout–movement–circulation), offering a link between behavior and humans. The wayfinding system design, generally speaking, is based on several considerations; these include that which is visible (such as color, line, shape, and other visible elements) and that which is invisible. These considerations are realized during the museum journey, according to specific spatial planning data that consider the issues involved at both a Pragmatic and Morphological level.

The concept of intelligibility is related to the concepts of connectivity and integration through a set of 12 properties that pertain to the spatial system, the number of nodes or points on the network, the relationship that spatial spaces have with circulation, the number of destinations on the pivot line, the symbolic dimension, the physical dimension, the functional dimension, the relational dimension, the type of planning employed, the transport elements (physical–functional), and the presence of a direct or indirect view of another site.

These properties are reflected on several levels, the most important of which is pragmatic. This is achieved through special design considerations applied to features such as the building approach, the building entrance, the configuration of the path, the path–space relationship, and the form of the circulation space.

Design considerations are considered at the Morphological level: orientation acts as a uniform spatial system, while navigation requires appropriate amounts of strategically placed information that contains verbal or pictorial semantics and direct visual intelligibility.

Taking all this into account, this study offers a starting point for future studies that hope to examine the various levels related to space syntax (such as the semantic level), in addition to the level to which the visual elements of the wayfinding system are applied within the framework of spatial planning design and the extent of the harmony between the various elements at different levels (Pragmatic and Morphological). Spatial analyses that concern human-based architectural design still require future studies to disclose the relationship between the spatial circulation system and the wayfinding system as a whole.

The results indicate that the level of intelligibility properties is generally low at both the Pragmatic and Morphological levels. Considering the high level to which the connectivity properties are reflected at the Pragmatic level (despite the weakness of their application at the Morphological level) and considering the weakness in the level of reflection of the integration properties in the blank sample as a result of adding in the application to the Morphological level and the intermediate level at the Pragmatic level.

In this context, the study requires the analysis to be completed through an examination of the direct visual elements, as these serve as an essential complement to the realization of the concept of intelligibility in the case study. As such, one of this study's recommendations to researchers in the field of spatial design is to take into account museum design in the context of communication with users.

TABLE IV
DESCRIPTION AND ANALYSIS OF APPLIED CONNECTIVITY CHARACTERISTICS ON A PRAGMATIC AND MORPHOLOGICAL LEVEL IN THE STUDIED SPACE

Level/**connectivity**		One spatial pattern system	The number of nodes or points on a grid	Spatial spaces and circulation	The number of destinations on the axial	Total (/4)	Value
Pragmatic (circulation)	1. The building approach	🔴	🟢	🔴	🟢	2/4	Average
	2. The building entrance	🟢	🟢	🟢	🔴	3/4	High
	3. The configuration of the path	🔴	🟢	🔴	🟢	2/4	Average
	4. The path–space relationship	🟢	🔴	🟢	🟢	3/4	High
	5. The form of the circulation space	🔴	🟢	🟢	🟢	4/4	High
Total value on a Pragmatic level						14/20	High
Morphological (layout)	1. Navigation Appropriate amounts of strategically placed information (figurative or verbal)	🔴	🟢	🔴	🔴	1/4	Low
	2. Orientation The one spatial pattern system	🟢	🟢	🔴	🔴	2/4	Average
Total value on a Morphological level						3/8	Low
Total value of both levels						17/28	High

TABLE V
MECHANISMS FOR DETERMINING THE VALUE OF THE LEVEL TO WHICH THE CONCEPT OF CONNECTIVITY HAS BEEN APPLIED

	Codification		
Value of applying the characteristics of **connectivity** on a **Pragmatic level (circulation) or Morphological level (layout)** for **each characteristic** (/4)	Low existing = 0–1	Average existing = 2	High existing = 3–4
Total value of applying the characteristics of **connectivity** on a **Pragmatic level** (circulation) **for all characteristics** (/20)	Low existing = 0–9	Average existing = 10	High existing = 11–20
Total value of applying the characteristics of **connectivity on a Morphological level** (layout) (/8)	Low existing = 0–3	Average existing = 4	High existing = 5–8
Total value of applying the characteristics of **connectivity on a Pragmatic level** (circulation) and **Morphological level (layout)** for **all characteristics** (/28)	Low existing = 0–13	Average existing = 14	High existing = 15–28

TABLE VI
DESCRIPTION AND ANALYSIS OF APPLIED INTEGRATION CHARACTERISTICS ON A PRAGMATIC AND MORPHOLOGICAL LEVEL IN THE STUDIED SPACE

Integration Level		Symbolic dimention	physical dimention	Functional dimention	Relational dimention	Planning type	Elements of transmision Physical, functional) (	Indirect view of another site	Direct view of another site	Total	Value
Pragmatic (Circulation)	1- The building approach	🔴	🟢	🟢	🟢	🟢	🔴	🔴	🟢	5/8	High
	2- Building entrance	🟢	🟢	🟢	🟢	🔴	🔴	🔴	🟢	5/8	High
	3- Configuration of the path	🔴	🔴	🔴	🟢	🟢	🔴	🔴	🔴	2/8	Low
	4- Path-space relationship	🟢	🔴	🟢	🟢	🟢	🔴	🔴	🟢	5/8	High
	5- Form of the circulation space	🔴	🔴	🟢	🟢	🔴	🔴	🟢	🔴	3/8	Low
Total value on Pragmatic level										20 /40	Average
Morphological (Layout)	1- Navigatio	🟢	🟢	🟢	🔴	🔴	🔴	🔴	🟢	4/8	Average
	2- Orientatio	🔴	🔴	🟢	🔴	🟢	🔴	🔴	🟢	3/8	Low
Total value on Morphological level										7/ 16	Low
Final Total value of both levels										27/ 56	Low

TABLE VII
MECHANISMS FOR DETERMINING THE VALUE OF THE LEVEL TO WHICH THE CONCEPT OF INTEGRATION HAS BEEN APPLIED

	Codification		
Value of applying the characteristics of **integration** on a **Pragmatic level (circulation) or Morphological level (layout)** for **each space characteristic** (/8)	Low existing = 0–3	Average existing = 4	High existing = 5–8
Total value of applying the characteristics of **integration on a Pragmatic level** (circulation) **for all space characteristic** (/40)	Low existing = 0–19	Average existing = 20	High existing = 21–40
Total value of applying the characteristics of **integration on a Morphological level** (layout) (/16)	Low existing = 0–7	Average existing = 8	High existing = 9–16
Total value of applying the characteristics of **integration on a Pragmatic level** (circulation) and **Morphological level (layout)** for **all space characteristics** (/56)	Low existing = 0–27	Average existing = 28	High existing = 29–56

TABLE VIII
SCALE ADOPTED TO IDENTIFY THE VALUE OF APPLYING THE CHARACTERISTICS FOR EACH CONCEPT

	Codification		
Value of applying the characteristics of intelligibility (/60), connectivity (20), and integration (/40) on a **Pragmatic level (circulation)**	Low existing = 0- 29	Existing = 30	High existing= 31-60
Value of applying the characteristics of intelligibility (/24), connectivity (/8), and integration (/16) **on a Morphological level** (layout) (/8)	Low existing = 0- 11	Average existing = 12	High existing= 11-24
Total value of applying the characteristics of **intelligibility in all characteristics** (/84) **on a Pragmatic level** (circulation) and **Morphological level (layout)**	Low existing = 0-41	Average existing = 42	High existing=43-84

TABLE IX
RESULT OF APPLYING INTELLIGIBILITY CHARACTERISTICS (CONNECTIVITY AND INTEGRATION) ON A PRAGMATIC AND MORPHOLOGICAL LEVEL IN THE STUDIED SPACE

Concepts/levels	Connectivity (/4)		Integration (/8)		Intelligibility	
Pragmatic (circulation)	14/ 20	High existing	15/40	Low existing	29/60	Low existing
Morphological (layout)	3/8	Low existing	7/16	Low existing	10/24	Low existing
Total	17/28	High existing	22/56	Low existing	39/84	Low existing

TABLE X
DESCRIPTION AND ANALYSIS OF APPLIED INTELLIGIBILITY CHARACTERISTICS ON A PRAGMATIC AND MORPHOLOGICAL LEVEL IN THE STUDIED SPACE

Concepts		**Intelligibility**														
		Connectivity (/4)					**Integration (/8)**									**Total (/12)**
Level		**One spatial pattern**	**The number of**	**Spatial spaces and**	**The number of**	**Total (4/4)**	**Symbol**	**Physical**	**Functional**	**Relatio**	**Plannin**	**ts of Elemen**	**Indirect view of**	**Direct**	**Total 8/8**	
Pragmatic (circulation)	1. The building approach	0	1	0	1	2/4	0	1	1	1	1	0	0	1	5/8	7/12
	2. The building entrance	1	1	1	0	3/4	1	1	1	1	0	0	0	1	5/8	8/12
	3. The configuration of the path	0	1	0	1	2/4	0	0	0	1	1	0	0	0	2/8	4/12
	4. The path–space relationship	1	0	1	1	3/4	1	0	1	1	1	0	0	1	5/8	8/12
	5. The form of the circulation space	0	1	1	1	4/4	0	0	1	1	0	0	1	0	3/8	7/12
Total value on a Pragmatic level						14/ 20										
Morphological (layout)	Navigation	0	1	0	0	1/4	1	1	1	0	0	0	0	1	4/8	5/12
	Orientation	1	1	0	0	2/4	0	0	1	0	1	0	0	1	3/8	5/12
Total value on a Morphological level						17/28									22/ 56	39/84

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