

Exploring the Concept of Visibility and Explaining Qualitative Indicators of Visible Buildings for Designing Urban Signs based on Citizens' Mental Images

Kaniya Bigham^a- Amir Reza Karimi Azari^b- Abbas Tarkashvand^{c*}

^a Ph.D. Candidate of Architecture, Faculty of Architecture and Urban Planning, Iran University of Science and Technology, Tehran, Iran.

^b Associate Professor of Architecture, Faculty of Architecture and Art, University of Guilan, Guilan, Iran.

^c Assistant Professor of Architecture, Faculty of Architecture and Urban Planning, Iran University of Science and Technology, Tehran, Iran (Corresponding Author).

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ABSTRACT

Visibility helps to create an image of an urban element in the user's mind and advances their environmental perception. Today, the lack of landmark buildings whose visibility creates urban legibility and promotes the user's perception of the city is being felt. For this, designing landmark buildings based on the visibility quality could be one of the main objectives of architects across the city. The question, however, is "What are the building indicators that make them urban signs due to their visibility?" To answer this question, the preset study first adopted a qualitative approach to explain theoretical foundations and describe five major indicators of visible buildings by employing library documents and examining available theories. Then, the study employed a field survey and a questionnaire to select as many as 14 landmark buildings with commercial and exhibit uses and identical historical and semantic features on a regional scale across Tehran. Meanwhile, sixty people were asked to name the buildings they could recognize by referring to their own mental images and to describe the reasons for recording the buildings in their image memories based on five [visibility] indicators using a Likert scale (from very low to very high). They were also required to draw a sketch of the place where the buildings had been constructed. The questionnaire's data were analyzed using descriptive statistics in the SPSS environment. To test the significance level of the hypothetical indicators, the variance analysis was used, with the three indicators of the buildings' form and shape, the buildings' location, and the buildings' differences in appearance from the surrounding texture in 14 buildings held a significance level of higher than 95%. Results indicated that the five indicators of the buildings' form and shape, the buildings' location, and the buildings' differences in appearance from the surrounding buildings, special lighting at night, and the materials used in the buildings contributed to the visibility of these 14 buildings, respectively, given the users' frequency of selection. As known, the distinction between the buildings' form and shape causes some differences in appearance from the surrounding buildings, while differences in appearance may be caused by color, rhythm, and other appearance-related features. Meanwhile, because previous studies focused primarily on visible buildings for, say, finding addresses and that users walk past them relatively hurriedly, they have failed to take the materials used in the landmark buildings into account, as, for example, special night lighting could make a landmark building qualify for visibility during a nightlife.

Keywords: Urban Signs, Mental Image, Visibility, Qualitative Indicators.

* E_mail: tarkashvand@iust.ac.ir

1. INTRODUCTION

Urban signs are landmark elements across the city that can be regarded as the elements influencing the legibility and identification of the city given their unique and indexical features. Converting an element across the city into an urban sign depends on various factors, including visibility, indexicality, background uniqueness, literal and semantic feedback, address-finding features, appropriate collective use, and appropriate movement axis designs toward buildings, among others. In this connection, building visibility designs through visibility indicators appear to be associated with architects and engineers. In the past, such buildings as mosques, minarets, and mills could become urban signs over time. Today, however, these textures are void of any urban signs due to the continuing and rapid pace of population growth and development of cities, as well as the construction of new areas within cities, such as satellite towns. This means that it is no longer possible to construct a building and wait to see it turn into a landmark urban sign over time; rather, it is the responsibility of architects to design and construct buildings that would be capable of turning into urban signs to help increase the legibility and social identity of the city. One of the solutions to design landmark buildings is visibility. There are scant studies on visibility. A summary of them is as follows:

In a qualitative study, Mohammadhassani, Toghraei, and Mirgholami offered a classification of urban signs to answer the questions “Which types of signs contribute the most to the legibility of the city’s structural passageways?” and “How would the three physical-visual, functional, and semantic components of the signs contribute to the way they are remembered?” Using a survey and an interview, as well as some mental images of people, the researchers asked for the reason why the signs (specifically city signs across Vali-Asr St. in Tehran) had been regarded as landmarks, analyzing verbal and non-verbal behaviors to investigate the signs based on a conceptual framework. This study did not, however, offer statistical information, a validity test of a questionnaire, or a sample population selection procedure. Findings revealed that functional-physical components and the variables of the type of use, the intensity of use, and indexicality held the highest influences on the legibility of urban signs (Mohammadhassani et al. 2014, 61-62).

Visibility, meantime, is one of the functional and physical components of a building. Karimi-Moshaver, in a study, investigated the techniques of studying urban views. Here, he used library documents and finally introduced seven main approaches to urban views, including local, visual, mental, physical, configurational, visual, and behavioral approaches. The goal of this research-promotional study was to lay the foundation for future studies on urban views in architecture, urban design, urban planning, and city

development studies (Karimi-Moshaver 2014, 3-4). Karimi-Moshaver argued that visibility served as an urban analysis approach. This technique is widely applied in cases where buildings must be examined exactly in terms of how they are influenced by urban views.

Tarkashvand and Majidi maintained that a sign is an element whose forms and functions may navigate citizens and induce a sense of place in them. In a qualitative study, they first recognized signs in an urban space and relevant theories, then elicited primary criteria based on the views of architecture and urban planning experts. They employed a questionnaire and used the method of weighting dependent variables for statistical analyses while scoring and measuring propositions to recognize the signs. The goal was to find the physical criteria influencing an urban element becoming a sign. The results found that the “distinction from the surrounding texture” and the “shared signification between users” were selected as the criteria for measuring the signs across the city (Tarkashvand and Majidi 2013, 5-6). The “distinction from the surrounding texture” is seen as synonymous with the form, which is one of the main indicators underlying a visible building.

Garnero and Fabrizio aimed to present a technique for estimating the visual effects of symbolically important or landmark buildings, such as skyscrapers which are different in scale from adjacent buildings. The researchers, however, worked on some samples as in the Italian city of Turin, using criteria for measuring visual intensity, the contrast between the goal and its surrounding environment, a sky/atmospheric view, and the process of object recognition. The samples they investigated comprised four buildings in the city of Turin, including a temple building, an urban sign, an element, and an under-construction skyscraper. According to their surveys, the new skyscraper was going to become a landmark in the city (Garnero and Fabrizio 2015, 688). The significance of this article lies in the fact that a building was first designed and then constructed as an urban sign.

In a study in Turkey’s Konya, Bala collected some case studies in a field survey to investigate the meaning of landmarks for the users who had understood it via their own memory and perception. His procedure included selecting photos to measure people’s attitudes. Using his interview text analysis, he identified six various types of signs as landmarks in the city of Konya, which were urban memory-historical buildings, urban-plaza perspectives, high-rise-skyscraper areas, daily life and city-urban memory, and personal perception-touring patterns (Bal 2016, 409). In this connection, skyscrapers and plazas have become urban landmarks for featuring visibility and visual perception.

Research papers were designed to investigate those directly correlated to the category of visibility. The literature on urban planning and urban designs has

partially referenced the concept of visibility, though failing to expand upon the related concepts and explore their features as influential visual quality. As stated, the research conducted on this domain has partially described categories that were somehow related to visibility and its impacts on urban signs. This study, however, is more detailed and inclusive than the past ones, seeking to employ qualitative strategies and correlation tests within a subjective space of a likely recognizable area to examine the quality of visibility and its effects on urban signs and to explain features of visible buildings. At first, the study used a qualitative approach to find definitions and to extract visibility indicators from library sources and views of experts like Lynch and Appleyard. Then, the process continued by performing the correlation test, developing a questionnaire, and paying a field visit, which was followed by randomly selecting the sample population from among 15 buildings with specific uses on a regional scale in Tehran. This was aimed at investigating their visibility based on peoples' mental images and researchers' observations. In sum, statistical analyses using the SPSS software, and a content analysis of the buildings' properties were carried out to provide the characteristics of the visible buildings based on urban signs.

2. THEORETICAL FOUNDATIONS

At first, a qualitative strategy was employed and library sources, as well as well-established theories on urban signs and visibility, were used to discuss the research framework and explain the visible buildings from the view of researchers. Here, the basic concepts of the study, including urban signs, visibility, and mental images needed to be examined. These concepts are of high importance when it comes to explaining the characteristics of a building that would turn into an urban sign due to its visibility.

2.1. Signs

Saussure presents a dyadic model of the sign: the signifier (sound/acoustic image) and the signified (concept image), suggesting that the sign is the product of a bond between the signifier and the signified (Saussure 200, 96). For Saussure, the signifier and the signified are not material and do not convey a concrete and tangible concept; rather they fall under an abstract and perceptual system (Sajudi 2011, 13-15). Therefore, the way the sign influences people involves an immaterial concept. To understand this concept, let's imagine a situation where we speak with ourselves or recall a poetic stanza in our mind without moving our lips (Saussure 2011, 66). Semiotics, meanwhile, posits that the sign is something that stands for something else, being made intelligible and semantically associative by it (Bani Masoud 2005, 159). In semiology, the sign is a meaningful unit interpreted as referring to something other than itself,

falling under the three indexical, iconic, and symbolic dimensions, as posited by Sanders Peirce (Faizi and Asadpour 2013, 111-112). Grouter argued that in semiotics each sign is examined in two apparent and semantic dimensions, with the former involving the appearance of the sign and the latter the concept and content of the sign, which the user must have already learned to ascertain the sign or have imprinted it in their mental image (Grouter 2014, 399). Moughtin and Partners believe that the sign refers to an element or a group of elements distinguished in a visual background by repetitive details (Moughtin and Partners 1999, 103).

As mentioned earlier, signs have a pivotal role in architecture and urban planning, and they are defined as external referents, showing the direction of a familiar and an unfamiliar environment and leading people towards them (Sokolova 2018, 463). To Lynch, signs are referents for decision-makers in space, allowing for space configuration and space direction. Lynch, in the meantime, maintains that signs are characterized by two features: uniqueness and prominence (distinction from the surrounding texture) across an urban scale (Lynch 2013, 144). As meaning-making factors in architectural perception, signs can be applied to promote a sense of place and create a better space quality within the architectural design process. Semiotic theorization describes three pragmatic, semantic, and syntactical variants to examine signs (Falihat and Noohi 2012, 23). Meanwhile, fabrics, functions, and meanings compose the building blocks of signs, as a landmark element may not exclude any of them to maintain its unity. Thus, formative identification is the most important feature of a landmark element. Many signs imply visual-physical components, while their functional and semantic dimensions receive less attention (Mohammadhassani et al. 2016, 64). Therefore, in architecture, signs are considered as visual landmarks strengthening the user's physical perception.

2.2. Urban Signs

Lynch identifies five main factors, i.e., paths, edges, districts, nodes, and landmarks that underpin people's mental image of the city, suggesting that visual legibility is one of the main goals of the city image and describing urban signs as playing a key role in legibility¹. Some scholars have elaborated on the various characteristics of a city with a legible image. Bentley argued that legibility is important on two levels: physical form and activity patterns. Places may be legible and understandable in one of these two levels (Bentley 2007, 113). Signs are the elements that stand out across the district, locality, region, alley, or even the city, enabling the observer to distinguish them from the surrounding texture. To Lynch, signs are considered as elements externally visible to the observer and their scales may vary dramatically (Lynch 2013, 144). As Pakzad pointed

out, an urban sign serves as a mental landmark in the city image and is represented by forms, functions, and meanings while creating a point of reference for a landscape to become a sign. An urban sign is a part of the environment that reveals itself to the observer and helps them to determine the location of other parts of the environment and other places (Pourjafar and Montazerolhojja 2010, 24-25).

The following concerns scholarly views on the characteristics of a landmark element (urban signs) in the city.

It is noteworthy that the visual-physical quality of public spaces across the city may be strengthened by increasing the level of [pedestrian] presence in public arenas, creating conditions where individual and collective memories can be recorded, creating a clear and legible image in the observer's mind, and providing a desirable design for axes of view towards landmark elements, not to mention others. Designing axes of view towards visual monuments and urban signs could contribute to citizens' mental images and help them better find directions (Pourjafar and Sadeghi 1999, 96). Due to their landmark capacity, high-rise buildings across the city will play a pivotal role in helping create mental images in the citizens' minds (Faizi and Asadpour 2013, 107). An urban sign, on the other hand, may involve buildings with social and cultural uses, or even any landmark element that helps to record memories and collective events for citizens. Urban signs make up a constant and reliable part of citizens' mental image. These elements are distinguished from the environment by their forms and functions, are recognizable to people, and are used to create a sense of place and navigation for citizens. Helping increase legibility, these landmark elements would represent the city's identity and underlay its future growth and development. Meantime, criteria for recognizing signs in urban spaces involve two main categories: indexical or distinction from the surrounding texture (by indexical, it is the ultimate limit of visibility) and signification shared by citizens (by signification, it is the recording [of signs] in the citizens' cognitive maps) (Tarkashvand and Majidi 2013, 6-9). A common feature between architecture and urban design involves designing axes of view toward landmark architectural buildings by urban designers, as an axis of view refers to a 3D arena or zone starting from a point of view and extending to a landmark element with a visual quality (Pourjafar et al. 2009, 74). Widening pedestrian zones and enlarging visible spaces will improve visibility (Karami et al. 2023, 46). Bell identifies the axis as a real or virtual line which, on both sides, are elements that are configured and replaced. To him, if streets enjoy a landmark point to draw the direction of the eye or are, generally speaking, visible, they would be regarded as a means for creating an axis (Bell 2008, 193). Criteria for designing visual axes toward landmark urban elements fall under three categories:

contrasts, uniqueness, and sequences (Kheiraddin and Ghoraei 2016, 8-9). For this, urban signs increase city legibility and provide a sense of place and social identity. In sum, the activity pattern and the level of [pedestrian] presence due to the building's use and the signification shared by citizens, the physical form and the indexicality of the sign due to its distinction from the surrounding buildings and its location, which helps create more visibility, as well as the imprinting of the sign in the environmental perception of citizens in the city, will certainly play crucial roles in turning a building into an urban sign. Here, visibility plays a fundamental role in citizens' perception and understanding of urban signs.

2.3. Visibility

Lynch identified visibility to be equivalent to indexicality. Indexicality in Lynch's theorization can be regarded as a combination of the ability of physical components in the environment to present a clear and legible image and the ability of the observer to choose, process, store, organize, and identify the image mentally (Pourjafar and Montazerolhojja 2010, 57). Visibility is sometimes considered equivalent to the term "indexicality", sometimes referred to as the ultimate limit of visibility.

The term visibility also denotes observability and indexicality and is used as an approach to urban visual analyses. In approaches to place [analyses], this term also denotes observability and how it comes into the observer's view (Karimi-Moshaver 2014, 78-79).

In the course of analyzing urban spaces, components of urban space involve forms, functions, and meanings. Speaking of forms and functions, Appleyard maintains that three features, i.e., form (the formative unit and distinction of the building from its surrounding texture), visibility (the location of the building in a place that is viewed better and more visible by observers), and use and significance (special land use) help to better understand the building (Lang 2015, 158). Visibility is a quality of a landmark element that creates a strong and evocative mental image in the mind of each observer (Larice and Macdonald 2007, 158). Therefore, the building's forms and shapes characterize the building's visibility. The approach to visibility describes whether or not an urban element comes into citizens' view; it also addresses the level and duration of visibility of urban elements. To interpret the environment, four indicators, namely vision, hearing, smell, and touch are key. The sense of vision is the most important and helps acquire the highest information from the environment compared to other senses (Carmona et al. 2010, 168). Using this sense, man experiences the space and creates in his mind an image involving continuous and configured cognitive maps (Pahlevan 2022, 39). The more intense and the longer exposed an element is, the more it is visible and the more visual effects it will have. While visibility analyses define

building (in)visibility by the 0 and 1 logic, visual analyses could offer better results by incorporating fuzzy logic. Visibility analyses concern the number of environmentally visible elements, the duration of the elements being exposed or viewed, the number of people observing the elements, and the distance from which the elements can be seen.

Accordingly, focal points for these elements include squares, intersections, and main streets. The visibility technique serves as an accurate measure to evaluate urban elements, helping to investigate how urban elements or buildings influence urban views such as high-rise buildings and buildings in sensitive urban areas (Karimi-Moshaver 2014, 4-6). Therefore, the building's location is also one of the indicators of visibility.

According to Oh (1998), the following should be simultaneously examined to measure visibility:

1. Physical dimensions of visible landscape sources
2. Significance and value of the sources

Spatial variables of legibility measured by visibility can be classified as follows: recognition of buildings (signs) and spatial configuration (urban forms) (Koseoglu and Winter 2002, 243). In the special edition of the Poetic Dictionary, Cowan defines an urban sign to be a building or structure easily visible from among the buildings or structures available in the background (Cowan 2008, 212). This is what Lynch termed prominence, considering the dominance of the building over the periphery representing a feature of its viability. For this, one more indicator of a visible building is its distinction from the surrounding

location, i.e., how it appears to be different from the surrounding buildings.

The man-environment connection is primarily characterized by man's visual and mental bond with the environment's architectural combination (Safamanesh 1994, 180). The building's façade influences the image of the city where it is located, as it transfers this influence over to the walls (Pakzad 2003, 82). Therefore, to create visibility, the building must feature some form and volume properties and represent a prominent shell. An urban view that would leave an appropriate image of itself in the mind of the user will help create more legibility (Habib 2006, 53). Meanwhile, the materials used in the façade of a landmark element are what would represent a differently representative shell than other buildings, making it a visible landmark element. Therefore, the materials used in the building façade are another indicator of a visible building.

During the day, urban spaces are illuminated by natural light and they usually need no artificial light. However, a high-quality lighting system helps create positive mental images. Special combinations across an urban landscape should be desirably illuminated to represent their significance, with landmark elements and referents being highly critical for visibility. Meanwhile, harmonious and compatible special element lighting will enhance urban lighting (Alavi Tabari 2016, 62). Therefore, special lighting for signs at night will be a key indicator and one of the reasons for their visibility across the city space. Table 1 below has summarily described indicators of visibility.

Table 1. Explaining and Analyzing Indicators of Visibility for Landmark Elements

| Visible Landmark Building Characteristics | Description |
|--|--|
| Building form and Shape | According to the specialized Urban Development Dictionary, urban signs are defined as famous structures and/or buildings that could attract attention (Cowan 2008, 212). The volumetric changes of a building, its volumetric area, and the extent of volume coming into the observer's view (Lynch 2013, 144), as well as its non-monotony and volumetric game, may help enhance the visibility of an architectural building. This will enable the architect to provide a conscious volume by designing a visible building based on the observer's view. |
| Differences of Appearance from Surrounding Buildings | Cities are commonly characterized by an identical urban texture across a regional scale. This urban monotony causes a lack of legibility across the city. The main factors influencing signs, however, include visual prominence due to facades, forms, and colors, along with semantic and structural prominence (Raubal and Winter 2002, 243). Signs, for some, are seen as buildings easily seen in the background from among existing buildings (Cowan 2008, 212). The literature has described height as an influential factor that makes the building be seen in the background. This is possible when the building's background texture excludes high-rise buildings. Overall, differences in appearance that include differences in colors, materials, sizes, compounds, heights, land uses, and many other features in the building in the background texture where the building is located, could result in more building visibility (Faizi and Asadpour 2013, 107). |
| Building Location | The building's location is easily viewed by the observer in areas where there is a wider field of view and a larger portion of the building is seen at better legibility with less inhibitory effects (Lynch 2013, 144). This will enhance the quality of visibility, giving the building a greater chance of being turned into a landmark element. In fact, the building's location, in what Lynch would suggest as an urban node (e.g., squares, intersections, etc.), could increase building visibility. One of the main reasons why a building is made visible and more legible is due to the recognition of the building (signs) in the urban spatial configuration (Kitchin 1994, 1). |

| Visible Landmark Building Characteristics | Description |
|---|--|
| Special Night Lighting | At night, cars and other buildings may not be as visible as they are at days due to the lack of adequate light, and if a building is set to become an urban landmark element due to its visibility quality, it must be constantly visible, which is not possible at nights unless with appropriate lighting. Landmark elements, when properly lighted, will serve as landmark points (Alavi-Tabari 2016, 62). |
| Building Materials | The façade of each building in a city represents an important effect and this effect is carried over to the bodies of the streets and nodes where the façade is situated (Pakzad 2007, 72). While an urban landscape is not restricted to the facades of the buildings in the city, the facades will serve as one of the main defining factors for architects and urban designers to create landmarks, since they are the most changing elements influencing the building's visual quality (Garcia and Rodriguez 2015, 45). Besides the buildings' forms, shapes and general volume, one of the main factors that affect the design of a visible landmark building's façade is the materials used in it. The materials can by themselves indicate the transparency, reflection, genus, color, porosity, and apparent features of the building. |

2.4. Mental Image and Environmental Perception

To accurately explain research procedures in this connection, it is required to investigate the concepts of mental images and environmental perception, as field research requires researchers to search for the mental images and environmental perception of the target community through a questionnaire.

However, before investigating the concept of mental images, we should bear in mind that in modern times, the separation of the subject from the object was widely accepted as a principle under the influence of positivism, with the separation from the subject seen across urban planning processes. This has marginalized man as the subject and made up a kind of standard architecture and planning. Here, Lynch begins to describe the concept of human mental images (Rahmani-Firoozjai and Mohammadi 2018, 38). It is widely known that man and the environment interact with and affect each other, as the mutual relationship requires man to feel and perceive the environment (Karami et al. 2023, 42).

To address the differences between urban landscape and the city image, we should pay attention to the fact that the landscape is what would come into the observer's view (i.e., visible to the observer), but the image is characterized by a whole lot of fabrics and their interrelationships, and even cultures and laws governing the city, which will result in a set of landscapes. The mental image or the city image represents a totality of symbols, signs, and physical elements that reflect concepts, values, meanings, and other interpretations. The urban landscape, however, is a set of sequences that come into the observer's view. To Lynch, the mental image encompasses all beliefs, speculations, and expectations that humans have about the environment which helps various values and qualities to be recorded in his mind. The mental image of the city is said to represent a value scheme of the urban landscape in the man's landscape (Pakzad 2007, 161). Lynch also argued that legibility depended on the space's ability to shape

people's mental images (Koseoglu and Onder 2011, 1191). Rapoport maintained that the city image is a totality imprinted in the human mind and is recalled even upon changing and leaving the environment. He argued that the mental image was the outcome of the interaction between the person and the environment (Rapoport 1977, 8). Therefore, the visibility of landmark buildings could have a direct impact on the formation of people's mental images.

Living in the environment, man enjoys values deemed to be greater than the environment, which will create a dynamic interaction between man and the environment. The environment is what would enclose the individual, even if they cannot comprehend all the existing information. Perception is a targeted process to receive what is sent via the environment. Environmental perception refers to the observer's perception of space from the perspective of the environmental concrete features. Thus, the city form perception is an interaction between the individual and the environment, which will produce different outcomes if one of them changes (Pourjafar and Sadeghi 2008, 98-99). Environmental perception results from the human knowledge of the environment and its spatial experience. For this, environmental perception results from the interaction of feelings and knowledge of people in the environment.

2.5. Mental and Cognitive Maps

Mental images represent quickly written and accessible signs that we use, recognize, and agree upon. These signs may vary from one individual to another and from one group to another and may be the outcomes of our tendencies, prejudices, and experiences (Downs and Stea 1973, 9). To Clarke, a mental image is a conscious manifestation of an image of the environment or a place. This map represents the reality in the human mind and is reserved, recalled, and interpreted as an outcome of information. This suggests that the visibility of landmark urban buildings helps record them in the mental images of citizens while shaping and changing their

environmental perception. Perception encompasses the collection, organization, and understanding of environmental information. Gibson emphasizes the movement [in the landscape] and utilization of the landscape, suggesting that perception is the outcome of directly experiencing the environment (Faizi and Asadpour 2013, 110). Therefore, when citizens move across the city, the visibility of the landmark buildings helps imprint the buildings in the mental images of people and contributes to creating cognitive maps and consequently, experiencing the urban environment directly.

There are two types of mental image (mental images and cognitive maps) representations as follows:

Topologic representation: Topologic representation is founded on the “spatial recognition” of the environment. This representation encompasses three types of knowledge: landmark knowledge (the information concerning the presence of a special

feature in a situation), path-route knowledge (the information concerning the path where one passes from one location to another), and navigation knowledge (the information concerning how the distance between the signs is calculated). These three types of knowledge are used in forming and using cognitive maps.

Verbal representation: Verbal representation makes use of summarized words and propositions resulting from “non-spatial environmental maps” (Asadpour et al. 2015, 15-16).

To investigate the visibility of a landmark urban element, the topologic representation of the sign should only be explored and the verbal representation of the element should be avoided if possible. This will help prevent the intervening factors and make research results more accurate and citable.

Figure 1 summarily explains indicators of visibility and recording of the signs in people’s cognitive maps.

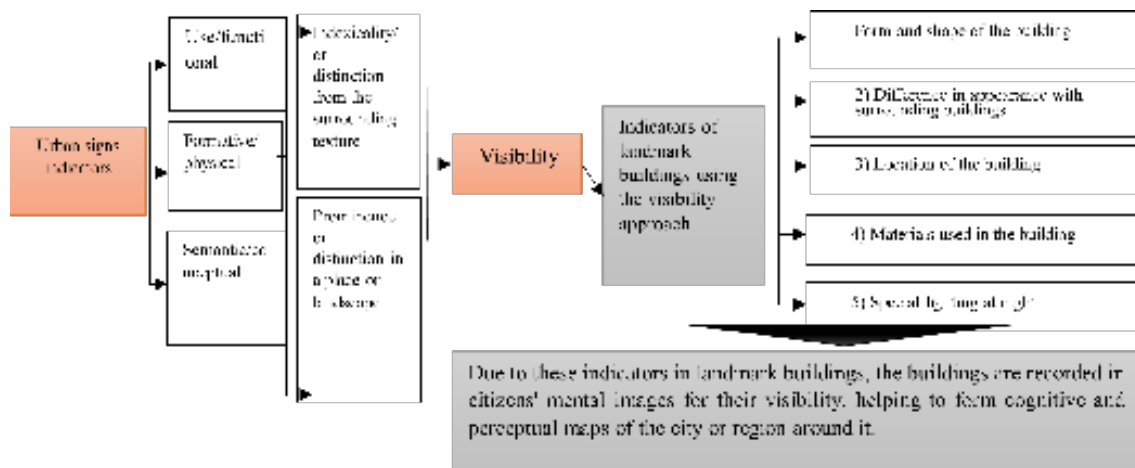


Fig. 1. Diagram of Signs Visibility based on Visibility Indicators




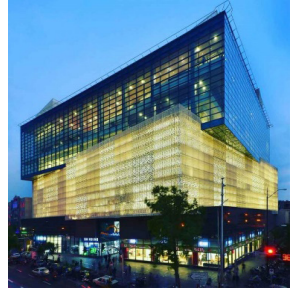

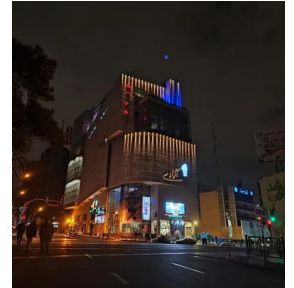



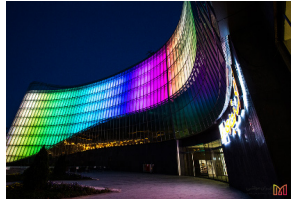


3. METHODOLOGY










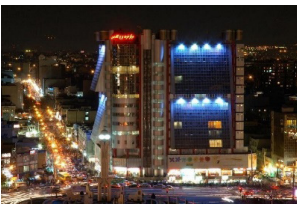

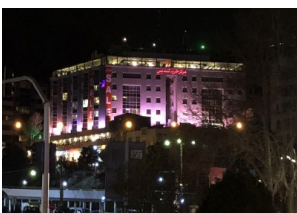

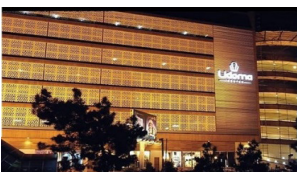
The present study employed library documents, and theoretical analyses, designed a questionnaire, and performed statistical analyses of the questionnaire to present well-established characteristics of visible buildings. In so doing, the study selected 14 large-scale landmark buildings across Tehran that featured space legibility and were potentially capable of becoming landmark buildings on an urban regional scale. These buildings had been constructed over the past 30 years, and measures were taken to prevent their old history from interfering with them from becoming urban signs. The buildings all featured commercial and exhibit uses, as the selection of buildings with certain uses helped avoid the plurality of uses to control for the intervening factors in the questionnaire. These 14 buildings featured some unique apparent forms across their regional textures and were illuminated at night by lighting. In terms of location, buildings situated in urban nodes or along

the streets leading to the nodes, i.e., from where the nodes could view the buildings were selected. Table 2 below gives names and volumetric characteristics of the buildings. It was previously explained that representation of people’s mental images could be made possible via two topologic and verbal representations. As for the representation of people’s mental images, the topologic representation of people’s mental images was examined, having been formed by the visibility of a landmark urban element. Meanwhile, the factors causing people’s mental images to be represented verbally were prevented to the extent possible to control for the intervening factors and their effects on the research outcome. The buildings’ historical age, their special uses, their landmark features across the entire urban scale, and the selection of the buildings from certain areas were all factors that could result in the verbal representation of people’s mental images. These factors were also controlled for in selecting these 14 buildings. In the

end, a field survey questionnaire was devised to select the buildings that could be regarded as urban signs due to their own visibility and indexical features.

Table 2. Landmark Buildings across Tehran on a Regional Scale, as proposed in the Questionnaire

| Building Name | Day's Photo | Night's Photo | Approximate Area of Land | Number of Floors on the Ground | Location of the Building | Year of Inauguration |
|---|---|---|--------------------------|--------------------------------|---|----------------------|
| Mellat Cinema Campus |  |  | 6000 | 3 | District 3 of Tehran, southern part of Mellat Park, near the Niayesh Highway | 2008 |
| Charsou Commercial/Recreational and Cinema Campus Complex |  |  | 5700 | 7 | District 12 of Tehran, the intersection between Jumphouri St. and Hafez St. | 2014 |
| Azadi Cinema Campus |  |  | 2800 | 10 | District 6 of Tehran, the intersection between Beheshti (Abbas Abad) St. and Khaled Eslamboli (Vozara) St. | 2007 |
| Kurosh Commercial/Recreational and Cinema Campus Complex |  |  | 9500 | 9 | District 5 of Tehran, the intersection between the Sattari Highway and Central Payambar Sy. | 2014 |
| Arg Commercial/Recreational and Cinema Campus Complex |  |  | 10000 | 5 | District 1 of Tehran, on Sa'd Abad St. before Tajrish St. | 2013 |
| Mega Mall Commercial and Cinema Campus Complex |  |  | 20000 | 5 | District 5 of Tehran, Phase 2 of the Ekbatan Township, the intersection between the Sattari Highway and Martyr Saremi Sq. | 2017 |

| Building Name | Day's Photo | Night's Photo | Approximate Area of Land | Number of Floors on the Ground | Location of the Building | Year of Inauguration |
|---|---|---|--------------------------|--|--|----------------------|
| Paladium Recreational/Commercial/Cinema Complex |  |  | 8800 | From one façade, 13, and from the other 11 | District 1 of Tehran, on Moqaddas-Ardabili St., before the Alef Sq. | 2012 |
| Tiraje Recreational/Commercial Complex |  |  | 7000 | 5 | District 5 of Tehran on Ashrafi Esfahani Highway, before Pounak Sq. | 2003 |
| Milad-Nour Recreational/Commercial Complex |  |  | 5500 | 8 | District 2 of Tehran, the intersection between Farahzadi Blvd. and Darya Blvd. | 2000 |
| Bustan Recreational/Commercial Complex |  |  | 9600 | 4 | District 5 of Tehran, the intersection between Mirzababaei Blvd. and Ashrafi Esfahani Highway | 1995 |
| Goldis Recreational/Commercial Complex |  |  | 3300 | 12 | District 5 of Tehran, the intersection between Sattar Khan St. and the second square of Sadeqiya | 2000 |
| Tandis Recreational/Commercial Complex |  |  | 2700 | 9 | District 1 of Tehran on Jafari St., before Tajrish Sq. | 2004 |
| Liduma Recreational/Commercial Complex |  |  | 4700 | 9 | District 2 of Tehran, the intersection between Farahzadi Blvd., and Simaye Iran Blvd. | 2015 |

| Building Name | Day's Photo | Night's Photo | Approximate Area of Land | Number of Floors on the Ground | Location of the Building | Year of Inauguration |
|--|---|---|--------------------------|--------------------------------|---|----------------------|
| Golestan Recreational/Commercial Complex |  |  | 7000 | 3 | District 2 of Tehran, the intersection between Iran Tamin St., and Mahestan St. | 1995 |

The reason why researchers used people's mental images was to utilize their visual memory that had been formed by the visibility of landmark buildings. This helped them avoid the interference of the intervening factors (the factors that caused a shared signification among citizens and mental images to be verbally represented), other than the buildings' visibility.

The representative population was selected using stratified random sampling and the Cochran formula from an unlimited population at an error rate of 0.1. The questionnaire was then given out to 60 people of varying ages and genders, as well as education levels and professions, aimed at creating a normal distribution under similar conditions. It is noteworthy that the statistical population consisted of 12-68-year-old people with education degrees of the seventh grade to PhD and various majors and professions, residing across different areas of Tehran. The statistical population was so designed to enjoy the necessary distribution across the city and society. The questionnaire was also devised in a close-ended and non-intervening form, as the researchers, during the course of the study, did not contribute to the thinking, understanding, and selection of the interviewees and consequently, their final responses. Using a close-ended questionnaire and selecting buildings with certain uses across urban scales could largely reduce the impacts of intervening factors on the study. Here in this field study, day and night images of the 15 landmark buildings with commercial and exhibitive uses were first shown to the interviewees, who were required to sort out the buildings that they would recognize in terms of appearance properties, names, and the location of the buildings. The day and night images were selected due to the effects of the lighting on the way the buildings could be recorded in the users' mental images. The interviewees were then asked to opt for four buildings from among the

selected buildings (if the number of the buildings they would recognize exceeded four) they could better recognize and remember more details in terms of appearance properties. They were finally asked to fill in the questionnaires for each of the selected buildings. This questionnaire did not directly question visibility because the interviewers sought to search for the mental images of the people and the reasons why they had recorded the images in their minds, which could be explained using the buildings' visibility indicators. This way, the researchers were able to search for the visual memories of the people and investigate the questions of "what is" and "where is" in the formation of mental images. Finally, 213 questionnaires were answered since some of the 60 people had recognized less than the four buildings required.

4. FINDINGS

According to the field study and Table 1, the most visible commercial and cinema building was the Mellat Cinema Campus, followed by the Azadi Cinema Campus, the Charsou Campus, and the Milad-e-Nour Shopping Mall, respectively. The SPSS software was used to calculate the table of data frequency, means, and standard deviation (SD) for each of the buildings. Table 2 that follows also gives the way the interviewees were selected and the reason why they were selected. The Zendegi and Golestan Campuses were only recognized by one individual, making it impossible to calculate their standard deviation. The standard deviation of the criterion for the selection of each building ranged from 0.79 to 1.19 on the Likert scale. This indicated that the reasons mentioned why each of the buildings had been recorded in people's mental images, as given in the questionnaire table below, could be considered appropriate reasons for the measurement process.

Table 3. Statistical Results of Analyzing Questionnaires to Explain Visibility Indicators

| Buildings' Names | Statistical Results | Number of Selections | Reasons for the Recording of Mental Images by People | | | | |
|--|---------------------|----------------------|--|---------------------------------|---------------------------|--|----------------------|
| | | Total | Buildings' Forms and Shapes | Materials used in the Buildings | Special lighting at Night | Differences in Appearance from the Surrounding Texture | Buildings' Locations |
| Mellat Cinema/ Gallery Campus | Data Frequency | | | | 23 | | |
| | Mean | 3.98 | 4.78 | 3.35 | 3.57 | 4.74 | 3.48 |
| | SD | 0.90 | 0.52 | 1.03 | 1.27 | 0.54 | 1.16 |
| Azadi Cinema | Data Frequency | | | | 17 | | |
| | Mean | 3.35 | 3.58 | 2.68 | 2.47 | 3.74 | 4.32 |
| | SD | 1.01 | 0.96 | 0.90 | 0.90 | 1.15 | 1.16 |
| Charsou Campus | Data Frequency | | | | 17 | | |
| | Mean | 3.87 | 4.53 | 3.59 | 3.53 | 4.35 | 3.35 |
| | SD | 1.00 | 0.72 | 1.12 | 1.01 | 0.93 | 1.22 |
| Milad-e-Nour Shopping Mall | Data Frequency | | | | 17 | | |
| | Mean | 3.36 | 3.69 | 2.87 | 3.00 | 3.44 | 3.81 |
| | SD | 1.19 | 1.01 | 1.30 | 1.32 | 1.03 | 1.28 |
| Kurus Shopping Mall | Data Frequency | 13 | | | | | |
| | Mean | 3.71 | 4.20 | 2.73 | 4.20 | 3.93 | 3.47 |
| | SD | 0.97 | 0.77 | 1.28 | 0.77 | 0.88 | 1.13 |
| Tiraje Shopping Mall | Data Frequency | | | | 11 | | |
| | Mean | 3.20 | 3.45 | 2.55 | 2.82 | 3.45 | 3.73 |
| | SD | 1.12 | 1.04 | 1.21 | 0.98 | 1.04 | 1.35 |
| Goldis Shopping Mall | Data Frequency | | | | 10 | | |
| | Mean | 3.81 | 4.60 | 3.60 | 2.44 | 4.40 | 4.00 |
| | SD | 0.95 | 0.84 | 1.26 | 0.73 | 0.97 | 0.94 |
| Boustan Shopping Mall | Data Frequency | | | | 9 | | |
| | Mean | 3.34 | 4.00 | 2.80 | 2.30 | 3.60 | 4.00 |
| | SD | 1.06 | 1.15 | 1.40 | 0.95 | 0.84 | 0.94 |
| Palladium Shopping Mall | Data Frequency | | | | 8 | | |
| | Mean | 3.83 | 4.75 | 3.14 | 3.13 | 4.13 | 4.00 |
| | SD | 1.03 | 0.46 | 1.35 | 1.13 | 1.13 | 1.07 |
| Tajrish Commercial Arg | Data Frequency | | | | 7 | | |
| | Mean | 3.80 | 4.43 | 2.86 | 3.57 | 4.00 | 4.14 |
| | SD | 0.91 | 0.53 | 1.21 | 0.79 | 0.82 | 1.21 |
| Mega Mall Shopping Mall and Campus | Data Frequency | | | | 5 | | |
| | Mean | 3.20 | 2.80 | 2.40 | 2.60 | 3.80 | 4.40 |
| | SD | 0.72 | 0.45 | 0.89 | 0.55 | 0.84 | 0.89 |

| Buildings' Names | Statistical Results | Number of Selections | Reasons for the Recording of Mental Images by People | | | | |
|-----------------------------------|---------------------|----------------------|--|---------------------------------|---------------------------|--|----------------------|
| | | Total | Buildings' Forms and Shapes | Materials used in the Buildings | Special lighting at Night | Differences in Appearance from the Surrounding Texture | Buildings' Locations |
| Liduma Shopping Mall | Data Frequency | | | | 4 | | |
| | Mean | 4.35 | 4.50 | 4.00 | 4.75 | 4.50 | 4.00 |
| | SD | 0.89 | 1.00 | 1.15 | 0.50 | 1.00 | 0.82 |
| Tandis Shopping Mall | Data Frequency | | | | 3 | | |
| | Mean | 2.87 | 4.00 | 2.67 | 1.00 | 2.33 | 4.33 |
| | SD | 1.07 | 1.73 | 1.53 | 0.00 | 1.53 | 0.58 |
| Total Means of People's Selection | | | 53.21 | 39.19 | 39.38 | 50.41 | 51.03 |

Table 2 gives the total means of the subjects' selection. As noted, the indicators were selected by the people in the following order:

1. Form and shape of the buildings
2. Location of the buildings
3. Differences in appearance from the surrounding texture
4. Special night lighting
5. Materials used in the building

The results indicated that the frequency of selection of the first three indicators was very close, with the

frequency of selection of the last two indicators being also close. As noted by the researchers, such factors as the duration in which the building was exposed to the observer's view, utilizing modern technologies, and color differences were among the factors that helped people record the appearance of the building in their cognitive maps. Future research is suggested to investigate such factors as modern technologies and color differences to deal with the visibility of landmark urban buildings.

Table 4. Total Means of the Interviewees' Selection of each Indicator

| Indicators of Visibility | Form and Shape of the Buildings | Materials used in the Building | Special Night Lighting | Differences in Appearance from the Surrounding Texture | Location of the Buildings |
|--------------------------|---------------------------------|--------------------------------|------------------------|--|---------------------------|
| Total means | 4.11 | 3.01 | 3.02 | 3.87 | 3.92 |

Since the Likert-scale questionnaire was used in the study, Cronbach's alpha coefficient was measured for the indicators using SPSS software to demonstrate the reliability and significance of the questionnaire.

This coefficient ranged from 0.7 to 1, underscoring the questionnaire was reliable. Cronbach's alpha coefficient results are given in the following table.

Table 5. Statistical Calculation of Cronbach's Alpha Coefficient for the Indicators of Buildings Visibility using the SPSS Software

| Indicators of Visibility | Form and Shape of the Buildings | Materials used in the Buildings | Special Night Lighting | Differences in Appearance from the Surrounding Texture | Location of the Buildings |
|--------------------------|---------------------------------|---------------------------------|------------------------|--|---------------------------|
| Total Cronbach's Alpha | 0.909 | | | | |

The statistical analysis of questionnaire results indicated that the factors of form and shape of the buildings, differences in appearance from the surrounding texture (being distinct), the location of the buildings, special night lighting, and the materials used in the facades respectively contributed to visibility and recording in the observer's mental images. These indicators were also tested using the Analysis of Variance Test via the SPSS software, as

given in Table 4. According to this test, the significant difference between the three indicators of the form and shape of the buildings, differences in appearance from the surrounding texture (being distinct), and the location of the buildings in the 14 buildings was lower than 5%, as the significance level of these three indicators in the 14 buildings was over 95%. However, the two indicators of special night lighting and the materials used in the building held lower

significance levels. This suggested that the indicators held a lower significance level in the 14 buildings. The level of significance in various tests was found to be different, with levels of significance of 95% and 99% reported favorable in Humanities and Medical

Sciences Tests, respectively. The level of significance for special night lighting and the materials used in the facades of the 14 buildings were found to be 87% and 71%, respectively.

Table 6. Test of the Level of Significance for Indicators by Analysis of Variance using the SPSS Software

| Indicators | Relationship between the Indicator and the Studies Buildings | Sum of Squares | Freedom Degree | Mean Squares | F ² | Sig. Level ³ |
|--|--|----------------|----------------|--------------|----------------|-------------------------|
| Form and Shape of the Buildings | Inter-Group | 50.579 | 13 | 3.891 | 5.680 | 0.000 |
| | Intra-Group | 92.481 | 135 | 0.685 | | |
| | Total | 14.060 | 148 | | | |
| Materials Used | Inter-Group | 23.278 | 13 | 1.791 | 1302 | 0.219 |
| | Intra-Group | 185.716 | 135 | 1.376 | | |
| | Total | 208.993 | 148 | | | |
| Location of the Buildings | Inter-Group | 72.042 | 13 | 5.542 | 5.575 | 0.000 |
| | Intra-Group | 134.200 | 135 | 0.994 | | |
| | Total | 206.242 | 148 | | | |
| Differences in the Appearance of the Buildings | Inter-Group | 60.447 | 13 | 4.650 | 5.242 | 0.000 |
| | Intra-Group | 119.741 | 135 | 0.887 | | |
| | Total | 180.188 | 148 | | | |
| Special Night Lighting | Inter-Group | 25.157 | 13 | 1.935 | 1.478 | 0.133 |
| | Intra-Group | 176.803 | 135 | 1.310 | | |
| | Total | 201.960 | 148 | | | |

5. CONCLUSION

One of the factors that help improve urban legibility is the presence of landmark elements and their distinction in the city that serve as urban signs. Signs are the key components that help understand the city, locate buildings, find addresses, identify the city, and create a sense of place in it. This study was concerned with some characteristics that could transform an urban element into a landmark element due to the quality of visibility.

To investigate landmark buildings based on the quality of visibility, the study adopted a qualitative approach by using library sources and credible scholarly theories and theoretically analyzing the existing information to explore the concept of visibility and explain inclusive indicators in visible buildings. To this end, the study examined the relationship between mental images and perceptual maps with the concept of visibility. Then, using the field research technique and case studies, as well as a questionnaire, the study investigated the explained indicators. These indicators were evaluated in 14 buildings with exhibit and commercial uses across a regional scale in Tehran, with 60 people being

selected as the statistical population. Descriptive results (marking the Likert spectrum ranging from very low to very high for each of the indicators in the buildings) were examined through statistical analyses of the frequency of data, standard deviation, and means using the SPSS software. According to the statistical analyses of the frequency of data and total means of the indicators selected by people, the five indicators of form and shape of the buildings, the location of the buildings, differences in appearance from the surrounding texture, special night lighting, and the materials used in the buildings respectively contributed to the visibility of the 14 buildings.

These indicators were also tested using the Analysis of Variance Test via the SPSS software. According to this test, the significance level of the three indicators of the form and shape of the buildings, differences in appearance from the surrounding texture (being distinct), and the location of the buildings in the 14 buildings was higher than 95%. The significance levels of special night lighting and the materials used in the buildings were 83% and 71%, respectively. Previous research had generally referred to the “distinction from the surrounding texture” as the

visibility factor of buildings, though they had failed to investigate how the buildings could be distinguished from the surrounding texture. The form and shape of buildings involve such dimensions as volumetric changes in a building and volumetric areas that may come into the observer's view. This indicator has been one of the factors that distinguish a building in the background.

Also, the indicator of differences in appearance from the surrounding texture causes a building in an architectural texture to come into the observer's view rapidly. The distinction between the form and shape of a building could sometimes create differences in appearance from the surrounding buildings; meanwhile, differences in appearance from the surrounding buildings arise from colors, rhythms, transparency, rigidity, and other apparent features in the building.

The indicator of the materials used in the building is concerned with the pace of movement and view of the observer, as the less the observer's speed of walking, the more details of the building will be revealed to them. The materials used could also help create indexicality and identification in the background's texture, with special night lighting creating more landmark building visibility in the city's nightlife in the neighborhood.

In sum, researchers found in their field studies that the factors of the duration and location of a building in a specific place and consequently, the duration in which it may come into the view of the observer, as well as differences in color and using modern technologies both in the structure and in the façade (e.g., using parametric shells) could affect the way the buildings are recorded in people's mental images. This is suggested to be taken up by future research.

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The authors state that they have directly participated in the stages of conducting research and writing the article.

ENDNOTE

1. Many theorists have so far discussed and defined legibility. Kevin Lynch (1960) describes a legible environment as a place that can be organized in a coherent and recognizable pattern. According to Lynch (1960), the degree of legibility depends on the ability of space to form a mental image. He argues that a city with a legible image may help recognize all components of the city (e.g., neighborhoods, interesting buildings, streets, and alleys) and imagine them as a coherent whole. Scholars have elaborated various features for a city with a legible image. According to Bentley et al., legibility is important on two levels: a physical form and activity patterns. Places may be legible and understandable in one of these two levels (Bentley 2007, 113). Defective legibility in

the city causes some problems for citizens. Reduced legibility decreases the recognition of the environment by the user, thereby resulting in a lack of sense of security and lack of identity among citizens (Haghgouie 2011, 34).

2. F or factor is calculated by dividing the sum of squares by their means. This is calculated to reject the null hypothesis and is compared in a table. However, the calculation by the SPSS software measures the significance level to reject the null hypothesis.
3. If the significance level is lower than 5%, the ratio of the indicators with the 14 representative buildings is said to be significant, at a confidence level of 95%. This indicates that the significance level is smaller than 0.05. If this value is smaller than that, it is indicative of the presence of intervening factors or less important samples.

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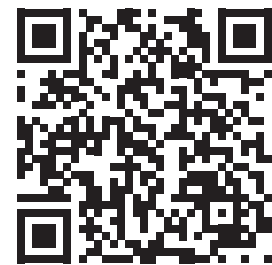
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