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Comparative Analyses of Tehran and Berlin Underground Urban Spaces Network with Emphasis on Identified Cognition Map and Historical Urban Landscape
Case Studies: Tehran & Berlin

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Abstract:
The underground metro network consists of a set of pauses and movements spaces. Stations are paused spaces and tunnels are subway networks. At present, in some metropolitan areas, it seems that citizens are more familiar with the metro network map in order to reach their destination, and the zero-city level map of the city is not very tangible for them. It is possible to strengthen the perceptual power of subway users by indexing subway stations. Indexing of some stations can create a good cognitive-perceptual map in the mind of the citizen so that they can use the underground transportation network frequently and have a correct understanding of the zero space network of the city. Cognitive-perceptual map is a tool that shows the degree of ease of understanding of the city for each citizen. The historical landscape of each city, due to its identity, can create significant points in the mind of the citizen. This makes it possible to understand the spatial coordinates of the city despite the shift in the underground network. So far, only the cognitive-perceptual map of the city has been proposed in the literature of urban design. In this research, identity-cognitive map is mentioned as a new keyword in urban design vocabulary. In this way, the problem of lost sense of belonging and identity of the underground urban spaces can be solved to some extent.

In this research, by comparative analyses method of "case-based", in two metropolises of Tehran

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and Berlin, the level of attention to the historical urban landscape in understanding the city map in designing metro networks and stations (through analysis of existing maps and field surveys) is determined.

In this study, the relationship between the historical urban landscape and the network of underground metro stations of the two cities has been determined. The results show that although in terms of network status and spatial quality, Berlin stations are superior to Tehran But in terms of urban graphics, Tehran is superior to Berlin. In both cases the identification of identity cognitive maps, both in terms of network design and station design, lack of compliance with the historical perspective and the vacuum of comprehensive basics of the subject is noticeable.

Keywords: Underground Urban Spaces Network, Historical Urban Landscape, Identity cognitive maps, Tehran, Berlin.

Introduction:

Underground metro stations are considered as pause public spaces in the underground mass traffic & transportation network in metropolitan areas.

Such underground urban spaces are the connection between the underground city spaces and the surface of the earth in a city. In other words, these are dominant platform of the urban space network. Normally, if a network is planned and designed properly, when moving from the point of origin to the destination, the direction of movement is understandable and the changes in the urban landscape are gradually visible to the citizen. Therefore, it will be easier for the citizen to understand the city map and have a good sense of orientation to find their way and destination. It would be easy for the citizen to understand the city map and easily locate themselves on the ground level (At zero-zero level). But when a citizen is positioned in a public space several meters underground and moving from origin to destination without understanding the gradual direction of urban landscape changes, he or she will not get a proper understanding of the city map. In other words, neither the perceptual map of the city nor the understanding of the city's historical cultural identity generally emerges in the citizen's mind. Emphasis on historical complexes inside and around the site, in design of metro stations can, in addition to improving the readability of the underground network, make the place of historical monuments in the modern and contemporary city more, important valuable, attractive colorful and indigenously identifiable. In other words, the role of historical urban landscape will be very effective in understanding the identity of the underground urban space network, and consequently the readability of the city. In this paper, at first, the research method and the literature survey of the subject are discussed. Then, introducing the two cities "case-based comparative" comparison of the two cities are performed and finally the results are presented.

Literature review:

Many experts have commented on the network of underground urban spaces and historical values. In this article, the opinions of some of them are mentioned below:

Godard (2004) quotes Giulio Carlo as saying that the purpose of designing a city is not just to design the city of the future. Rather, the Office of Heritage knows that in addition to economic value, it also includes historical, aesthetic, cultural, moral, and individual values. In this way, these values remain subconsciously ingrained in the mind.

Lu (2012: 1) believes: Often, historic centers that are limited by their form and scale have many problems. For example, there is usually, the high volume of traffic during peak hours, the interference between high land prices and low quality of life, lack of public spaces and living spaces around

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them. According to Farahani (2016:45) it can also be a challenge that the historical range loses its vitality.

In connection with the problem of traffic volume in the peak hours, it points to the increasing impact of pollution and climate change on environmental erosion in the historical context and further destruction of the context and adverse effects on its originality. She considers a comprehensive approach to the protection and management of the historic city necessary. Broere (2016: 248) sees underground development as an important tool in the development and redevelopment of urban areas to meet future challenges. In his view, the placement of infrastructure and other equipment in the basement provides an opportunity to understand new functions within urban areas without destroying the historical heritage. In addition to its impact on the Earth's surface environment, it also provides a good opportunity for long-term development in an environment affected by cities and the efficient use of space and resources. Vähäaho (2013) believes that: A comprehensive plan of underground urban spaces can improve the evolution of urban morphology and scientific planning theory. Planning mechanism can make efficient and logical development of urban underground spaces. Along with the underground network of urban spaces, the type of view of the historical areas on the city bed, determines the authority of the correct strategy for how the two are homogenous. UNESCO has a different view of historical boundaries in cities; for example, in UNESCO's view of historical urban landscape, it is defined beyond the traditional expressions of "historical centers," "collections," or "adjacencies." (UNESCO, 2005: 2 & 3- quoting Androudi and Taghipour Anari, 2018: 76). Following the development of today's approach to how historical interventions have taken place, UNESCO adopted a letter of recommendation in 2011 on a "Historic Urban Landscape" approach for protecting the heritage of historic cities. In 1976, it considered archeological and paleontological sites in an ecological context to be valuable due to the accumulation of cultural-historical values and features (Farahani, 2016: 44), (Riahi Moghadam, 2012: 21) and (Androudi and Taghi Pour Anari, 2018: 84).

According to the historical landscape of the city, nature, society and culture are intertwined in a historical city (Azarmi and Bahmanpour, 2017: 31). This approach is considered to be the cause of the integration and coordination of contemporary and new interventions with the historical heritage in the urban historical complex. By preserving the heritage with the aim of preserving the identity and general characteristics of historical cities, since the historical urban landscape has focused its attention on urban areas, and to read and understand them, it uses the method of separation and historical stratification of their values and

quality. Carefully in the text of UNESCO's eighth paragraph, following the definition of the historical urban landscape approach, "layering of values" is one of the key concepts of this text. This concept changes the way we look, the way we evaluate the environment, and the type of information we get. Due to the fact that we are familiar with urban areas with a large volume of information, this way, by obtaining different and innovative information, it increases the sensitivity. This approach uses a kind of landscape analysis method (bed perception through stratification of landscape bed features). In this way, the analysis of geographical information using thematic maps is used. This method provides a comprehensive understanding of the geographical area by recognizing the components of the patterns and discovering the relationship between them (Farahani, 2016: 50). Based on what has been stated by Taqvaee and Motahhari Rad (2014: 15), in the historical perspective of the city, the main emphasis is on the cultural layers and the natural layers are in the second priority regarding the subject of culture (Figure 1). The network of underground urban spaces should not only have a comprehensive planning in accordance with the area plan and comprehensive plans of the city. But, it should also be consistent with the network of historical and cultural complexes of the city.

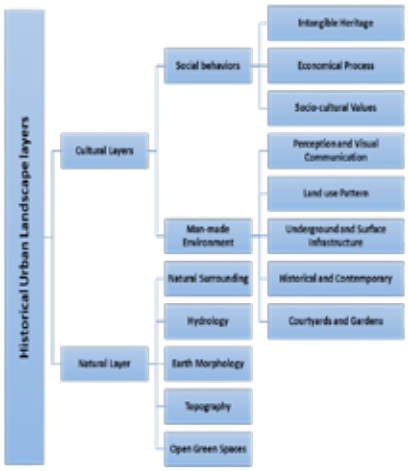

Figure 1: shows the landscape layering in the urban historical landscape approach.

Therefore, matching the performance indicators of the underground network, such as intersection and terminal stations with the historical indicators of the city, can increase readability and, as a result, provide a more desirable identification of the underground urban spaces network. Emphasis on matching metro stations with historical sites (and their cultural landscape) and paying attention to their historical and cultural homogeneity is one of the solutions that can make this matter more feasible and stronger.

Perceptual Cognitive Map:

The term or perceptual map was first coined in 1948 by Talman. He used the term in his study to estimate the behavior of mousses in how they searched for food in tortuous environments (Tolman, 1984: 189). Cognitive maps are a method used to organize and store spatial information and allow our

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eyes to visualize images and landscapes to increase mental capacity to enhance information recall and learning (Pourjafar, 2010: 28). The perceptual and quality of the environment is reflected in various ways on the human mind. Through the identification of the environment by its elements and components and the way of their communication pattern, human beings identify the environment and then move themselves in the environment. He interprets the environment by remembering the components of the environment and representing them in his mind. This process can be called cognitive or perceptual mapping.

Cognitive mapping is actually a combination of understanding the structure of the environment and the characteristics of the mental concepts of the environment. The most important features of environmental perceptions quoted by Sidanin (2007: 64) are:

Size and complexity: The environment cannot be understood all at once. To understand it all, in all its complexity and detail, it is necessary to decompose it all over time.

Surrounding: Because it encompasses our environment, we decompose it from within. We move around inside and from start to finish, and we're part of that.

Targeted communication: We generally deal with the environment with a specific goal and program in mind. Many studies show that urban maps play an essential role in the process of administrative mapping. Studies show that in areas where there are urban signs, people make more accurate cognitive or perceptual maps in their minds (O Laughlin and Brubaker, 1998: 595).

Today, urban planners believe that perceptual maps play a very important role in policy-making and urban development. It seems that urban designers can make better decisions and create more readable environments by being aware of people's perceptions and preferences in different environments. On the other hand, considering the important position of urban landmarks and especially historical complexes in the formation of perceptual maps, it seems important to pay more attention to these elements in urban plans.

Routing:

Routing is "the ability to locate and reach a destination in a mental and behavioral environment"

(Prestopnik and Roskos-Ewoldsen, 2000: 17). Appleyard and Lynch and Myer, (1964) consider navigation to be a perceptual and dynamic process where movement in space requires successive conflicts in reading, interpreting, and representing that space. Routing is actually a complex activity involving various processes, spying, search, and information resources, of which signs are a part. This activity depends on age, sexual differences, sense of direction, familiarity with the environment, and routing strategies (Thompson and Travel, 2007: 112). In simpler terms, routing can be de-

fined as “The process of using environmental and spatial information to find the right path to reach your destination”. In other words, routing means:

Do you know where you are? Do you know where you want to go? Do you know how to get there? A common consensus on routing is that there are two main strategies for routing in humans: The first is a general understanding of the spatial structure of the environment and key locations. The second case is based on people’s awareness of the places and paths that connect them (chain experience) and are used for guidance (Thompson and Travlou, 2007: 112-113).

According to Pasini (1996: 319) proper routing in environments depends in part on the imagination and embodiment of that environment of all the experiences that will take place in that environment. Routing is part of the process of guidance in urban environments. In fact, a person can reach his destination by routing and moving in urban environments. Throughout history, man has used various objects such as sunrise and sunset, mountains, maps and compasses to find his way to his destination. In urban environments today, routing is done by maps, signs, street signs, urban signs, recently software (such as Applications, Google Maps, Weiss, etc.).

Routing and moving in urban spaces are two completely intertwined stages. In fact, these two are the two main stages in the development of administrative or cognitive maps in people’s minds that lead to guidance in urban spaces and environments. Therefore, from the above discussions, quoting from Pourjafar (2010: 32), it can be concluded that:

In the field of routing, the task of the urban planner and designer is to guarantee the routing activities of the people in urban environments by using some important principles, and some of the most important of these principles can be expressed as follows:

-Each urban space and environment has its own unique cultural and historical identity.

-Roads and passages have a smooth and understandable structure.

-Avoid excessive amount of information entering the observer from the environment.

-Use early and special identification signs and symbols in order to create special points such as the existing homogeneous urban signs (such as historical monuments) in the structure of the city.

-Use signs and symbols to show different paths in change and decision-making points.

-Create different areas in the city that have distinct visual characters.

Research materials and methods:

This research will be carried out by means of comparative analyses method considering the necessity of underground urban spaces network survey in 2 different geographical locations with distinct historical

urban landscape and emphasis on their similarities and differences. Here, Adaptive orientation leads to improved measurement and conceptualization (Mohammadpour, 2018: 320). One of the characteristics of comparative research is its high capability and ability to use quantitative method (Qani Arani, 2016: 74-73). With regard to specimen designation, the method used for comparative research is case-based.

Hence, within the qualitative paradigm, multiple dimensions of commonality in each of the two samples are studied by differential-shared technique. The purpose of this study was to explain and explain the different experiences of Tehran and Berlin metropolises and the extent of perceptual and cognitive identity in the area of metro underground urban spaces. The basic strategy of this research relies on the observed findings.

Case studies:

Tehran's historical urban landscape:

The city of Tehran has a heritage related to different historical periods. The most significant historical complexes of Tehran in the historical context (Safavid fence) is the center of modern Tehran. Despite the historical background of Tehran as one of the villages around ancient Rey, the beginning of the development of this city dates back to the Safavid era. The city of Rey, adjacent to Tehran, has the longest history, with significant historical monuments such as the Tughral Tower and the Gabri Fortress, belonging to the Seljuk and Sassanid periods. Among the most important buildings built during the reign of Nasser al-Din Shah were the Golestan Garden, the Garden and Palace of the Sultanate of Abad, the Sepahsalar Mosque and School, the Ferdows Garden, the Shams al-Amara and the Amin al-Sultan Square. This area covers all historical events in Tehran as long as it was the main area of the city. Since the time of Nasser al-Din Shah and the development of the city of Tehran during this period and the first and second Pahlavi, many important historical events in Tehran. One of the events of the constitutional era and the Islamic Revolution took place outside the boundaries of the Safavid fence (Rahvand Shahr Designers, 2013). In addition, some prominent historical complexes such as Niavaran Palace, Saadabad and Tajrish Bazaar, related to Qajar periods. And Pahlavi is very important in the north of today's Tehran and outside the Safavid boundary (table 4).

Berlin's historic cityscape:

Berlin today, as the capital of Germany, is made up of two old residential areas. One is Cologne, located on the island's museum grounds, and the other is in Berlin, on the northern bank of the Shapra River. Both were founded in the 13th century. And. In 1307, the two residential areas of Berlin and Cologne merged. It was first proposed in the 13th century that Berlin should be the capital of the country, but this was delayed

until 1871 (www.eligasht.com, 2019). During his short reign, Friedrich Wilhelm rebuilt and developed the city in 1688-1640, and magnified Berlin with magnificent buildings. Today's Ondre de Linden Street is the same evolution (http://www.prolog-berlin.com, 2019). After World War II, the city was devastated. The four victorious Allied powers divided parts of the city: the Soviet Union, the United States of the Southwest, the British West, and the North West of France, with the construction of the Berlin Wall. On August 13, 1961, the division of Berlin was sealed. East Berlin could no longer travel west of the city. On the night of November 9, 1989, the doors of the Berlin Wall suddenly opened

The whole city and the whole country celebrated. In present-day Berlin, historical monuments from periods such as the Second German Empire, such as the Brandenburg Gate and the Gendaman Macket Square, are mostly concentrated in the center of the city, and some monuments, such as Charlottenburg Palace, are scattered elsewhere (table 5).

Tehran Metro Underground Network:

At present, the underground metro network of Tehran consists of 7 main lines. Lines 1 and 4 also have branches for connecting to Imam Khomeini and Mehrabad airports through exchange stations (Figure 2). Tehran metro stations are summarized in 4 types of exchange, intersection, terminal and normal. In the metro network, unlike many metropolises, each tunnel is dedicated to a specific line. This has made Tehran Metro Network one of the most readable metro networks in the world, despite the number of lines of its kind. Tehran Metro Network is somewhat in line with the network of high-speed buses and has a relative coordination with the entire bus and taxi network of Tehran. But it does not mean accurate time-space coordination. Although the Tehran metro network covers some historical monuments and areas, it seems that this limited amount of coordination of the location of historical monuments has not been one of the main goals of locating many stations. It is obvious that most of the stations have been located due to the limitations of urban and geological facilities and ownership, and the traffic-functional indicators have been located, and not in coordination with the density of historical monuments and cultural landscape. Tehran metro in the central part of the city is more connected to such areas than other places.

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Figure 2: Tehran Metro Network Map - Source: Tehran and Suburbs Urban Railway Operation Company, 2020.

Berlin Underground Network:

Currently, the underground metro network of Berlin consists of 9 main lines (Figures 3 and 4). What is evident in the map of the Berlin Transport Network is the position and hierarchy of stations, or in other words, pauses. For example, the two stations, Hopenhof and Scorco, are the main stations of the Berlin Transport Network. Both stations are located in the historical sections. Another highlight is the allocation of several lines in one route and service more often in the

Figure 3, Metro Network and Rail Transportation Map of Berlin, Source: http://www.transit-maps.com, 2019.

historical and central parts of the city. Berlin's rail transport network consists of two main parts: the surface on the ground with the abbreviation "S" and the underground with the abbreviation "U". Figure 4 shows the structure of the Berlin Metro network in a simplified way and with a circular presentation so that the centrality and key crossroads and terminals can be examined. The central ring of the Berlin metro network covers the historic area of the city center. Due to the concentration of most of Berlin's historical monuments in the middle of the ring, the historic section has good coverage.

Figure 4: The structure of the Berlin metro network, source: (Derrible, 2012: 2).

Discussion & Result:

Here, it can be stated that the development and maintenance of a network of underground urban spaces in order to form a perceptual map of identity requires observance of the principles of historical urban

landscape. To have a new look at preserving and improving historical boundaries and the urgent need for underground network of urban spaces to perceptual readability through the identity, goals and principles of the historic urban landscape shall be well known. The location of historical monuments and complexes, which are the key elements of the two cities of Berlin and Tehran, Compared to the underground metro network, it can indicate the degree of coordination of the historical urban landscape with the underground urban space network (Tables 1 and 2 &3).

The remarkable point is the existence of the central ring in each city and the extent of its coordination is the position of historical monuments (Figure 5).

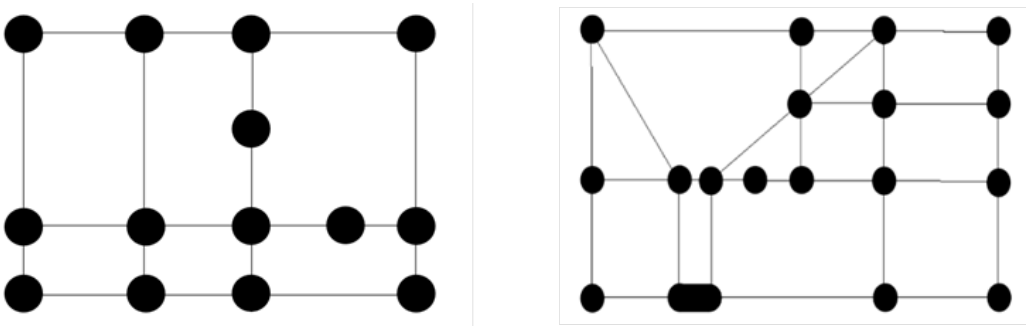
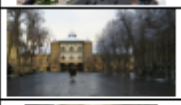
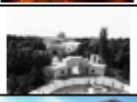


Figure 5: The pattern of the rings of the central historical area of the cities of Tehran and Berlin. Source: Authors

Table 1: Berlin historical monuments & complexes, Source: Authors

Historical important complexes of Berlin							
code	Location of Various Historical core of city	Name	Picture	Date	Location	Accessibility	
						Distance from metro station, (m)	Types of Accessibility
1	Center	Brandenburg Gate		1790		200	Pedestrians and bicycles
2		Berlin Wall Memorial		1960		550	Bicycle-vehicular
3		Garter Tier Garten		1699		600	Bicycle-vehicular
4		Museum Island		1829		450	Pedestrians - Bicycle-vehicular
5		Olander Street		1572		500	Pedestrians - Bicycle-vehicular
6		Gendaman Model Square		1699		147	Pedestrians and bicycles
7		Reichstag		1883		180	Pedestrians and bicycles
8	East	Uberbaum Bridge		1894		200	Pedestrians and bicycles
9	West	Caesar Wilhelm Memorial Church		1860		250	Pedestrians and bicycles
10		Charlottenburg Palace and Park		18 century		600	Bicycle-vehicular
11	South	Victoria Park		1893		400	Pedestrians - Bicycle-vehicular

Table 1: Berlin historical monuments & complexes. **Source: Authors**

Historical important complexes of Tehran							
code	Various Historical core of city	Name	picture	Construction time- century	Location	Accessibility	
						Distance from metro station, (m)	Types of Accessibility
1	North	Tajrish Bazaar		Qajar era		200	vehicular - Pedestrians - Bicycle
2		Saadabad Complex		Qajar and Pahlavi era		1300	vehicular - Bicycle
3		Niavaran palace		Qajar era		1600	vehicular - Pedestrians - Bicycle
4		Bagh Ferdose		Qajar era		1150	vehicular - Bicycle
5	Center	Meidan Toopkhaneh		18		Near the square	Pedestrians - Bicycle
6		Meidan Baharestan		18		450	Pedestrians - Bicycle
7		Meydan-e-Mashgh		17		380	Pedestrians - Bicycle
8		Tehran Bazaar		Zandieh-Qajar era		220	Pedestrians - Bicycle
9		Meidan-e-Hassanabad		1930		In the square	Pedestrians - Bicycle
10		Marble Palace		Pahlavi era		250	Pedestrians - Bicycle
11		Museum of Ancient Iran		1937		400	Bicycle - Pedestrians
12		Qasr Prison		1789		450	Bicycle - Pedestrians
13	South	Bibi Shahrbanoo Tomb		Safavid era		6190	vehicular
14		Ray Bazar		Qajar era		1480	vehicular - Bicycle
15		Gabri Castle		Sassanids era		2900	vehicular - Bicycle
16		Tughral Tower		Seljuk era		2200	vehicular - Bicycle

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Inside the spaces of main station, the presence of very large openings has caused a wide view.

The area of Berlin's main and central stations is much larger than that of Tehran central stations.

The central station of Hopen Hof has a very large commercial segment. But, despite being commercial, the subway and train route is at the highest level and is completely separate from the commercial sector. Routing in Berlin is impossible without a map and you have several options to reach your destination. This may confuse you with reaching your destination. Overall, the train subway lines of Tehran are more regular and readable. Unlike the complex and integrated structure of the Berlin rail transport, the readability of the Tehran metro network is better. In Berlin, in addition to the low average distance of stations, access to historical complexes is more favorable than in Tehran. This problem seems to be gradually resolved with the increase of stations. There is not much knowledge among the people of Tehran about using the subway stations by reading maps. People find their way more by getting used to recognizing, signs, and particular elements, colors of lines & station furniture and usually by asking from each other.

For this reason, the metro map must be very regular, legible, and not confusing. The map of Berlin shows the concentration of historical monuments in the center and the scattered existence of some monuments in the west and east of the city (Figure 6). Berlin's extensive transportation network, through its efficient underground network and paused spaces, covers historical areas well (Figure 6).

Figure 6: Location of Metro stations and Historical landmarks in Berlin
Source: www.styleshouts.com/wp-content/uploads/2015/08/mappa-berlino-travel-blogger.jpg, 2019.

Table 3: Indicative components of Berlin and Tehran Metro Networks
Source: Statistics of Tehran, 2019, (Derrible, 2012: 2) and (Derriblel, S. and Kennedy, Ch., 2010), Edited by authors based on mentioned references.

Components of Metro Networks Evaluation of Historical Metropolises of Berlin and Tehran		
Components	Berlin	Tehran
Network Length(km)	152	200
Number of Stations	170	139
Number of Lines	9	6
More than 1 Line in the Tunnel	Yes	No
City Population (million)	3.6	8.9
Number of Trips (per year)	475	728
Service Space (sqkm)	1044	1021
City Area(sqkm)	891	1200

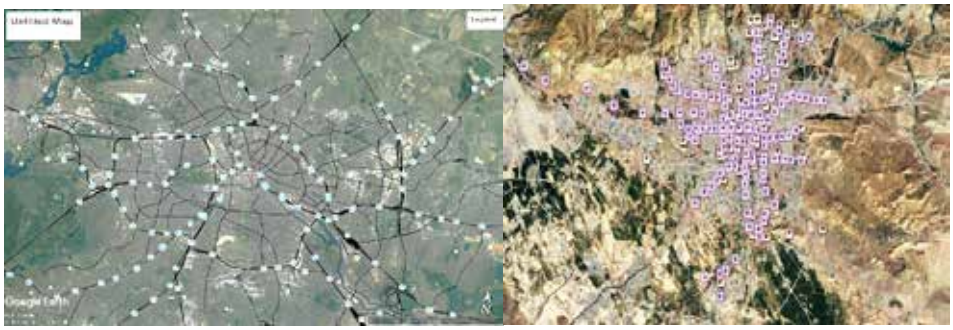
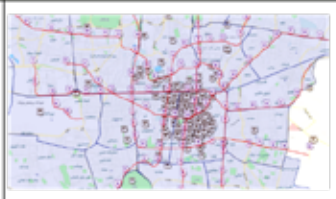


Figure 7: Distribution of Metro stations in the cities of Berlin and Tehran

Table 4: Core Areas of Historical landscape of Tehran, Source: Authors

Core Area of the historical urban landscape of Tehran			
Title	South	North	Centeral area
Map			
Distribution of historical monuments and subway stations	Distribution of historical monuments and inadeqate coverage of historical urban landscape by lines 1 and 6	Scattered distribution of historical monuments and average coverage of historical urban landscape by 2 lines 1 and 3	Dense distribution of historical monuments in the middle of the central ring of the metro network And the efficient coverage of the historic urban landscape

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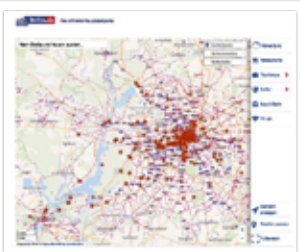
According to the literature reviewed, the study of the metro network in Tehran and Berlin, by field observations, findings can be indicators of network structure and readability. These are: the average distance between stations, the connection of historical complexes and stations, the optimal access to historical complexes through underground metro stations, the extent of the metro network's adaptation to the historical network and stations (as historical urban landmarks in both underground networks), which were evaluated. By help of Delphi method through urban design and architecture experts who were familiar with the status of both networks, through scoring between 1 to 10 evaluation were performed (Table 6 &7).

Table 5: Indicators of the historical landscape of Berlin, Source: Authors

Core Area of the historical urban landscape of Berlin			
Title	The area around east and west		Core area
Map			
Distribution of historical monuments and subway stations	Distribution of historical monuments and optimal coverage of the historical urban landscape by Line 5 and additional coverage with other rail transportation system	Distribution of historical monuments and medium coverage of historical urban landscape by lines 7, 2 and 3	Dense distribution of historical monuments around the central rings of the subway network And quiet efficient coverage of historical urban landscape

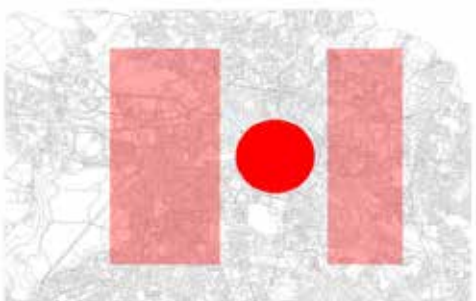


Figure 8: The main historical cores & cultural landscape of Tehran and Berlin according to the underground network of metro stations. Source: Authors

Table 6: Comparison of subway network indicators in Tehran and Berlin, Source: Author

City	Network structure	Network legibility	The average distance between stations (m)	The connection of historical complexes with stations (Score out of 10)	Optimal access to historical From the network) (Score out of 10)	The extent to which the metro network adapts to the historical traffic network (Score out of 10)	Historical land mark Score out of (10)
Tehran	3	7	(1000)-7	7	4	6	3
Berlin	8	4	(850)-9	5	8	8	4

Table 7: Design analyses of relation of central stations of Tehran and Berlin with indigenous historical complexes around them (with particular reference to harmony & contrast, score out of 10), Source: Author

City	Harmony of Entrance location with surrounding environment	contra st	Landscape Harmony	Area	Distribution levels for functions	Influence Zone	Volume
Tehran	4	9	4.5	6	3	7	4.5
Berlin	2	7	5	5	7	5	9

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According to the layers of historical urban landscape (Figure 1), there is 4 layers of socio-cultural values, visual perception and communication, land use pattern and infrastructure

Underground and ground floor are closely related to the underground urban space network, which has been evaluated through field observations and Delphi analysis methods (Table 8).

Table 8: Study of historical urban landscape criteria of underground station spaces network in Tehran and Berlin (Score out of 10), Source: Author

City	Socio-cultural Values	Perception and Visual Communication	Land use Pattern	Underground and on the Surface of Ground Infrastructure
Tehran	5	5.7	4	5
Berlin	3	3.5	7	8

The historical urban landscape in layers of socio-cultural values, visual perception and communication, land use patterns and underground and underground infrastructures has a common chapter with the network of underground urban spaces. The more layers of his-

torical urban landscape coincide with the network of metro station spaces, a city will have a higher perceptual cognitive map and thus easier navigation .In Berlin, the pattern of land use and underground and underground infrastructure is more consistent with the metropolitan area network than in the case of Tehran.

In this way, Socio-cultural values and visual perception and communication are somewhat more desirable in a few stations in Tehran than in Berlin (Table 8). At the Berlin Metro, the stations, despite their conflict with the surrounding historical area, have a sufficiently large area in proportion to the scale of performance. The volume of space in Berlin metro stations is much more emphasized than in Tehran and has caused a more favorable spatial quality (Figures 7 and 8 and Tables 8). Problem 10 indicates the expansion and more optimal distribution of the metro network and stations in Berlin than Tehran. In comparison of the underground network of urban spaces (metro stations), the two cases of Tehran and Berlin, in general, the proportions of the underground metro network of Berlin and the distribution of stations in the city seem more efficient.

Comparison of the parameters in both networks suggests that the case of Berlin, despite its smaller population, has a more favorable distribution in the metro stations. As can be seen, the level allocated to the metro is higher than the city in Tehran, but the method of distribution and allocation of the level is not desirable for each station. (Figure 9).

Figure 9: Comparison of some of the components of Tehran and Berlin Metro Network, Source: Authors.

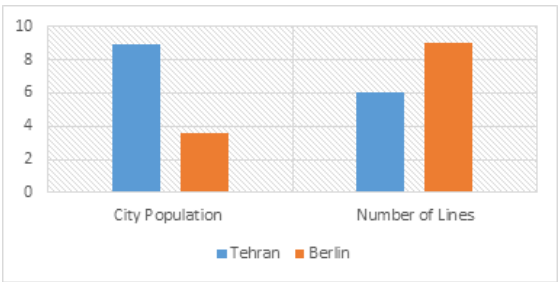

Figure 10: Comparison of Tehran and Berlin metro network indicators, Source: Authors

Conclusion:

The city of Berlin, though, has less monuments, population and area than Tehran But the network includes wider lines and stations, which is much more efficient in terms of quantity and quality and infrastructure than Tehran. The historical urban landscape of Tehran is summarized in three main cores located to the north, center and south of the city. This kind of distribution, in order to better match the underground transportation network and the historical

urban landscape, demands a more accurate and planned distribution in the north and south poles of Tehran. Modifying the network at these two cores (specifically south of the city of Rey) will raise the level of conceptual mapping of Tehran's underground urban spaces network. In contrast to the Berlin Underground Network, it is more in line and harmony with the existing pattern, given the central core of the monuments and the distribution of monuments in East and West Berlin. The Tehran Underground subway network, despite its ease and readability, makes for a poorer cognitive perception map and route than Berlin. Tehran's historical urban landscape is richer than Berlin's, but the Tehran metro underground network needs to be more closely aligned with the historic urban landscape in order to promote identity. This can be achieved through deep comprehensive studies to create underground corridor opening near by a historical urban landscape and remarkable monuments and landmarks in future. This, along with a homogeneous interior design with surrounding, would help to create an efficient "Indigenous Identifiable Cognitive Map".

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