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Developing a Conceptual Model of Legibility Relying on Mental Imagination*

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Abstract

Problem statement: The concept of legibility that has been added to the range of qualitative concepts of human-made environments after Lynch's seminal work, has been always associative of the five-aspect elements he introduced from the physical landscape of the city. This physical aspect-oriented perspective has directed the focus of research on the image that is formed in the mind from the environment rather than the one that observes has shaped in their minds from the physical components. The present study, therefore, raises this question: What are the components of observers' mental image of the physical environment?

Research Objective: This study aims to understand the concept of legibility and to provide a conceptual model of component communication.

Research Method: The research was conducted based on qualitative content analysis, in which, first, the documents and opinions of experts were investigated. Next, the study examined different aspects influencing the mental image creation and then, with logical reasoning, presented a conceptual model for a more comprehensive study of the concept of legibility.

Conclusion: The results show that the perception of the environment in the observer's mind, in addition to spatial components, includes both human and temporal components. They can be subcategorized into three groups. The first regards spatial mental image including the components of identity, and structure. The second is temporal mental image comprising of individual, collective experience and social events. And the last regards emotional mental image including sense of place and community as well as physical, historical and emotional assessments. Accordingly, the concept of legibility is not a physical characteristic of the physical environment. It is a multidimensional subjective concept, and its measurement is based solely on the physical characteristics of the physical environment, so that it relies exclusively on the spatial layers of the mental imagery. For a more comprehensive assessment of perceived legibility, other temporal and emotional layers in the mental image should also be considered.

Keywords: *Legibility, Spatial Mental Image, Temporal Mental Image, Emotional Mental Image.*

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Introduction and problem statement

Although the legibility concept is considered as a research subject in architecture and urbanization; at the same time, it has been less investigated as an independent and applicable variable (Kaplan & Kaplan, 1989). The first Lynch's research should be considered mostly focused on the physical aspect and legible city image in the observer's mind that is used for evaluating the environment legibility extent by routing indices that are only one of the legibility consequences. And that was later considered as the legibility in the descended routing simplicity in the environment. Although, Lynch mentioned other effective aspects on the formation of phantasm in his next researches, by simply focusing on the role of the observer on expanding the phantasms. At the same time, he did not review the imageability concept and as its result the legibility concept. Therefore, the criteria that are presented in the studies related to the legibility are mostly focused on space physical structure and are based on the identity, structure and concept components that he presents in the definition of the phantasm of the environment. Whereas, the interaction criterion of the person with the surrounding environment is the observer's imagination of those components. Based on this, evaluating the legibility by routing and addressing simplicity measure is an obvious and accessible term in readable environments and it does not introduce all the imagination aspects and dimensions that the observer has from his surrounding environment. On the other hand, all the efforts that have been performed about the development of phantasm are mostly focused on the physical components concepts and were based on the semiotics science. Although they were somehow capable to separate or interpret the effective components, at the same time, due to lack of the necessary population, they were not an expandable approach (Rapaport, 2013). Based on this, the cognition of the thing that the observers generate from the environmental imagination in

their minds or in more correct terms, the phantasm of the observer from the environment can be a route for the more comprehensive study of the legibility concept.

Method

This research was conducted in the qualitative approach framework. Therefore, at first, through using the qualitative content analysis method, the documents study approach and library resources study, the experts' opinions about various effective aspects on the formation of the phantasm of the human about the surrounding environment were discussed. Finally, with the logical reasoning from its relationship with the legibility concept, which is somehow agreed by all the related definitions, a conceptual model will be presented for evaluating the legibility perceived from the physical space.

Theoretical basics and research background
• Legibility concept

This concept was first introduced by Kevin Lynch. He, by relying on the environment visual qualities, assumed the legibility degree as the space physical aspect capability by using features like shape, color and the order that can generate a specific image with a strong texture from the environment in the observer's mind (Lynch, 1995). Although the legibility is affected by spatial characteristics, at the same time, the physical layers are only one of the various layers that exist in acknowledging the surrounding environment. Other research have been performed to study the legibility concept and its relationship with other environmental concepts with the aim of acknowledging the perceptual-cognitive characteristics of the observer. Kaplan, along with the introduction of the informational variables matrix, believes that the legibility is related to the perception of the environment (Kaplan, 1989). On the other hand, Schultz assumes the legibility as one of the components of the place character that is effective in the sense of place and location belonging. Rogan, also, by introducing

the legibility as one of the three variables of sense of place, defines it as the perception and preference of visual environment and activities compatibility with the human goals (Najafi & Shariff, 2011). Some others consider social dimensions for legibility concept by referring to the role of social environment besides the spatial relationships as two interwoven concepts in understanding the urban space, and consider the social legibility as the complementary for the spatial legibility and consider it based on a cultural chain and human interaction with its surrounding environment (Ramadier & Moser, 1998). Therefore, legibility is a comprehensive and multi-dimensional concept and we cannot evaluate it by just relying on its physical dimension. On the one hand, there is a quality and capability in an object that can obviously be perceived. On the other hand, it is related to the amount of its relationship with mental structure and values and concepts of the society. It implies environment conformity with emotional and mental capabilities and cultural structure. That is, both are affected by spatial shape and its quality and on dependent on the culture, character and experience situation of the observer (Lynch, 2014). Therefore, evaluating this kind of concept based on people's routing simplicity that is used in many related studies as a criterion for evaluation of the legibility of an environment, is only a portion of the characteristics of a readable environment and will not be a complete correspondence.

• **Evaluation of the legibility concept**

The studies related to legibility, besides separation of the components like visual access, prominence of signs, composition, and criteria like simplicity, clarity, cohesion, perceivable and organized, have made the role of some effective factors on the legibility concept more clear. However, due to mental nature of the perception and diversity of the phantasms of the audiences from the environment indices, and the concentration of these criteria on the spatial structure, the evaluation of the legibility level of the environment is very difficult. Maybe,

one of the reasons for lack of comprehensive knowledge of this concept could be recognized in the research approach type to this category; because, in the research that are focused on the physical environment indices, usually the role of the person is non-significant in relation with the environment and the related studies about the relationship of the person and the environment is more focused on the effect of behavior on the cognitive map. Alike Lynch, who does not consider the differences between the observers with the reasoning of the non-existence of shared basis for creating the meaning between the citizens , in order to exhibit the effect of physical differences of the environment (ibid.). Mental and multi-dimensional nature of the perception and as a result, legibility has resulted that some people try to explain and evaluate it with the help of other concepts. In this way, Pions, besides considering the image of the city as one of the components of its clarity, tries to explain this relationship using semiotics science. Although, urban landmarks are not fully matched with the terms that are called as signs both in the application terms and also in the content terms and the position of some physical components is only the spatial reference spots in the people's phantasms instead of being the signs that the signifier and signified relationships are used in their analysis. This research assumes that all the definitions related to legibility are unanimous in creation of a clear and coherent image of the environment in the observer's mind. Accordingly, recognition of the effective factors, layers and the process of formation of the person's phantasm of its environment is considered as a framework for better evaluation of the legibility concept. And it makes an attempt to reach a conceptual model for the relationship of these components with the legibility.

• **Mental image**

This concept was first introduced by the Tolman in 1932. He, by criticizing the stimulus-response theory, believed that the people create mental

images from the environmental signs and indices based on the beliefs, values, their viewpoint and also, different conditions in a cognitive map in their mind. They use it when the motivation and condition are proper (Tolman, 1948). Although Lynch used the conceivability word in relation with the urban body in defining the legibility concept, at the same time, this mental image is a collection of images that are formed in our mind from the appearance, performance, and meaning of a space (Trieb, 1974). In fact, anything that remains in the mind of a person after observing a scene, is the mental image of that person from that scene, i.e. both the result of the instant feeling of the person and also, based on his/her past memories and experiences (Lynch, 1995). Therefore, the mental imagination, besides the local components that are the result of the environmental image that form in the mind of the observer, include the cognitive components that are based on the believes and values of the person and the emotional components are arisen from the positive and negative feelings of the person for a phenomena and also, the behavioral components (Tayyebi & Zekavat, 2017). On the other hand, because the analysis of the development and expansion of a phantasm needs the analysis over time (Lynch, 1995), temporal components could be considered for it. In other words, the mental image could be considered as the interaction of the human with space and time; therefore, a phantasm at least includes the local, temporal and human components.

• **Spatial components**
Gruter considers the possibility of identifying a space related to the limiting components and its character as a function of the order between these components. Edmond Biken also believes that the thing that converts the space and places mental ratio to the visual and perceivable ratio is the physical structures and each mental and qualitative category must be converted to the body and tangible subject so it could be perceivable

(Falahat & Shahidi, 2015). Therefore, despite the generality of the geographical capability of human, while studying the formation of a mental image from the environment, it's necessary to investigate the physical conditions of the built environment as an independent variable (Yaski, Portugali, & Eilam, 2012). So, by using the physical plan as a work context and not a limiting factor, a visual map could be created that its goal is to reinforce the mental image of the people from the city vision (Lynch, 2016). The people, in their first contact with a physical environment create a primary image from the buildings masses and their relationships with each other in their minds. In fact, the thing that Lynch dealt with in his first study was the primary image from the local relationship between the physical components that form in the observer's mind. He introduced the mental imagination components based on the identity, structure, and meaning that in fact forms in the mind of the observer as a representative of all the things except this primary image. Lynch felt that people have far powerful perceptions of identity and structure compared to the meaning (Nasar, 2014). Therefore, he studied the local components more in creation of mental images in his studies. Whereas, besides the two factors of identity that are related to three-dimensional qualities of architecture and structure that are related to the two-dimensional layout of the space, the scale and performance of the space can be effective in the formation of this primary image from the environment as the two controlling factors. So, some people consider the signs more effective in the neighborhood scale and the node in the scale of the city (Rahimi & Rafieian & Bagheri, 2014). On the other hand, the people, have specific expectations or perceptual expectations with respect to the performance of the space that in case of incompatibility, is effective in perception of the environment. In fact, these two components could be mentioned as the limiting physical components in the formation of the mental image. Also,

some physical components have special position compared to other points in this phantasm layer due to the characteristics of the form or structural position and proper visual accessibility, which have great role in its coherency.

• **Temporal components**

The time as the fourth dimension, effective on the physical environments, is almost important in all the design aspects including how to perceive the environment, importance of the spaces due to the historical background and meaning, durability and conformity places flexibility and morphological processes (Kermona & Tizdel, 2015). Mumford considers the cities as the products of the time and believes that in the city, it is the time that somehow becomes visible. Therefore, the past periods preserve themselves in the city layer by layer and as life continues. The analysis of the expansion and development of the mental image, as is a dynamic perceptual process, needs analysis during time. Lynch by referring to the orientation of time considers the formation of the mental pattern as an important issue and considers it as a temporal-image (Lynch, 2014). These shared temporal images, according to Gisen, can link a nation or a society by the time or space together in the format of collective memory or as a time map and give shape to the individual identity. These memories give meaning to our existence and give directions to the time and spatial dimensions of our lives (Siew-Wai Lim, 2000). This layer of mental imagination creates the spaces connections to the other times in people's minds and Lynch points to it in explaining the routing concept. The source of temporal images mostly comes from the individual and collective activities that are based on the performance of the physical environment that goes on it and is formed in the interaction duration of the person with the environment and also through the individual and collective memories. Nasr assumes these individual experiences are very important in the recognition and reinforcement of the mental images that are obtained by the people in daily life

(Nasr, 2014). While, the awareness of the person from the relationship of a place to other times can give more depth to this temporal image by relying on the historical importance and background of a place and as written or auditory documents. Lynch believes that the historical knowledge must be shared with the people because of enjoyment and educational dimension of it and the remainder of spatial references of these memories induces a sense of security and continuation to the person (Kermona & Tizdel, 2015). This temporal image can both have temporal references and also can make some places as the references or spatial harbors in people's minds based on the diversity and variety of people's experiences that are not necessarily the same as the reference points in the first spatial image.

Human components

Although the formation process of the mental image in people's minds have general similarities, different cognitive maps will form in people's minds due to the perceptual differences affected by the mind, gender and people's needs. Lynch assumes the observer's portion effective in the development of mental images from the surrounding environment as an inventive person that changes his/her mental images with the change of needs (Lynch, 1995). Appleyard, also, by pointing to the inferential methods in understanding the environment perception, relies on the role of cognitive backgrounds in the perception of the person from its environment (Appleyard, 1969). Miller, by stating that the surrounding environment is only in the role of environmental information sender, states that it's the human that based on his character, identity, goals, experiences, and values infer this information. At the same time, despite mentioning the role of observer's cognitive differences, many believe that the mental concepts can have many shared components between the citizens; therefore, by sex, age groups, class, national and

social levels, and even the physiological similarities categorization, it tries to classify the people based on these cognitive-perceptual indices. By the way, the role of observer's cognitive-inferential components in interaction with the environment and formation of mental image from the surrounding environment cannot be ignored. The people, besides the physiological differences, based on their cognitive background that is affected by the worldview, culture, individuality and collective values, norms, traditions, rules and components arisen from the social environment that in which a person , record the mental images of the environment. These two components can be considered as two filters or human limiting subjects in recording the mental images. The physiological components affect the sense from the environment and psychological components on the recognition and valuation of the mental images from the environment. On the other hand, Appleyard, by introducing the reactive method in perceiving the environment, somehow points to the emotional reactions and sensory perceptions of the human from the environment. He believes that the people keep the information in mind if they are important. Then, after creation of emotional layer related to that information, record them as the individual or collective memories (Appleyard, 1969). Both could be both in the form of positive emotions and accompanied by happiness and also in the negative form due to the depression, sadness or fear. In fact, people, create a general understanding accompanied by the emotional feelings towards a place. In other words, a general image with the emotional aspect from the environment in his mind. The image can either be about a place related to the individual experiences, or related to the collective experiences and the social environment that Lynch considers it as an important member of the people's mental structure (Lynch, 2014); (Fig. 1).

The role of Socio - behavioral environment

Each person, due to his social characteristics, refines the information obtained from the

environment and saves an image from a place in his/her mind. Also, the places are introduced based on the thing that people say about them. In other words, although, the local feeling might be personal, the result is the general perception of a society. Therefore, recognizing a place is a social phenomenon (Hauge, 2005). Garling believes that the spatial representation is formed of two parts; first, the personal experience and meaning that organizes the cognitive map of the city; and second, the reliance of that representation on the general perception and social sharing that is saved in the meaning memory (Garling; Book & Lindberg,1984). On the other hand, Altman considers a great portion of the human social behaviors as A result of the mutual interaction of the cultural – environmental factors and considers the behavior as the result of the perceptions and viewpoints of the people from the social environment. Yangol believes that social activities are dependent on the presence of the other in related spaces or somehow the social spaces (Gol, 2018). Even Lynch considers the social homogeneity of a place stronger than the physical design for creating the feeling of a more powerful biological complex (Lynch, 2014). Therefore, in recording the mental images from the environment, besides the physical space components, the social space components are always considered important that emerge in the form of individual and collective behaviors. Although in a co-structure or a behavioral-physical synomorphy, these two spaces are in interaction with each other, for studying the spatial components, the role of social components as a formation basis can be considered.

Mental evaluations

The evaluation and creation of mental image are in interaction with each other. The related people with the surrounding environment are not neutral or indifference and remember the places that have powerful feelings about them. Lynch considers the contribution of the observer
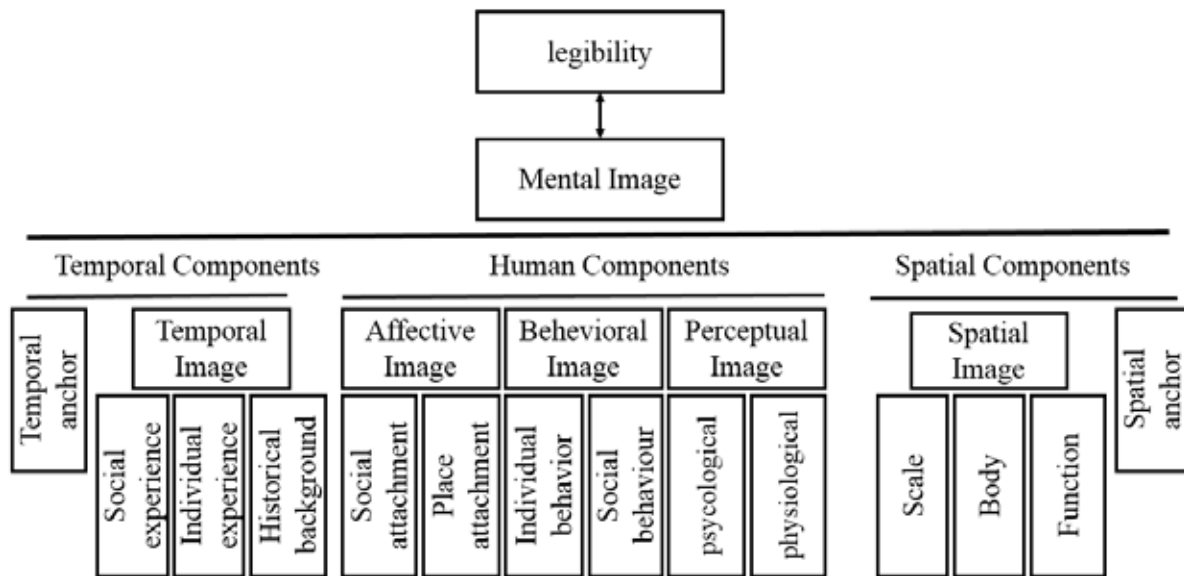
Fig. 1. The Mental Image Components. Source: authors.

effective in expanding the mental images from the surrounding environment as an inventive person that changes his/her mental images with the change of his/her needs. In fact, people feel the environment based on the evaluations that come from the feelings, conclusions and human behaviors. Nasr considers the mental image as the result of the observer's evaluative analysis from the surrounding environment by implying on the role of human characters and observer's mental background. This evaluation might include the feeling that is directly related to the form structure and a little needs the perception and mental activity. It can also arise from the conceptual meaning of the form (Nasr, 2014). Therefore, the people, at first filter the information they obtain from the environment and create their mental images and then, after creating the mental images, separate and highlight some points in each layer. The related evaluations with the spatial components are the result of the formal, aesthetic or physical/ applicable characteristics evaluations that Appleyard names it as space motivational amount. The emotional evaluations are also the result of the positive or negative associations that

are formed from the experiences of the people from a place and is both related to the feeling that people have from a physical environment and Nasr calls it as the loveliness of the space. People have some judgments about the importance of historical background of a place based on the characteristics and physical environment performance and they are considered as the criteria of their interaction with the environment.

Discussion

This research was started by criticizing the legibility concept evaluation, by the mere emphasis on the spatial mental images and routing and addressing measures that are only a part of the legible environment characteristics. Although, in the related studies to legibility concept, there is always a creation of a bright and coherent image spoken as a criterion for evaluating the legibility, at the same time, there are a few types of research that study all the dimensions of the mental image in the evaluation of the legibility in a physical environment. Therefore, this research, with a focus on the mental image formation process as the connector of the definitions related to legibility,

made an attempt to acknowledge the dimensions effective in it and presented various layers of the mental image and sub-components of each layer in a conceptual model (Fig. 2).

Although the mental image is an interwoven and integrated concept and we can hardly consider precedence and lateness for its layers, at the same time, this conceptual model is illustrative of the existence of different layers of mental image that recognizing them can help us in line with a more comprehensive evaluation of the legibility concept. At first, in an interaction with the physical environment, people make a spatial image from the physical components and their relationship in their mind that the formal and structural characteristics of the physical environment have a great role in its formation and consistency. Then, proportional to the interaction duration with the environment and

in the form of personal experience or interaction with other people in social events, people create temporal images in their minds that somehow includes the personal and collective memories or the background or the history of a place through written or auditory resources. These temporal images provide the feeling of belonging to the place by the remembrance of their memories and also belonging to the society that has common temporal mental images with them that are, in fact, the emotional-mental images related to that place. The human components are effective in evaluation, grouping, and valuation of the mental images in the format of the physical and emotional evaluations and historical importance on the one hand as the physiological characteristics in the environment feeling and psychological characteristics. On the other hand, personal and collective behaviors
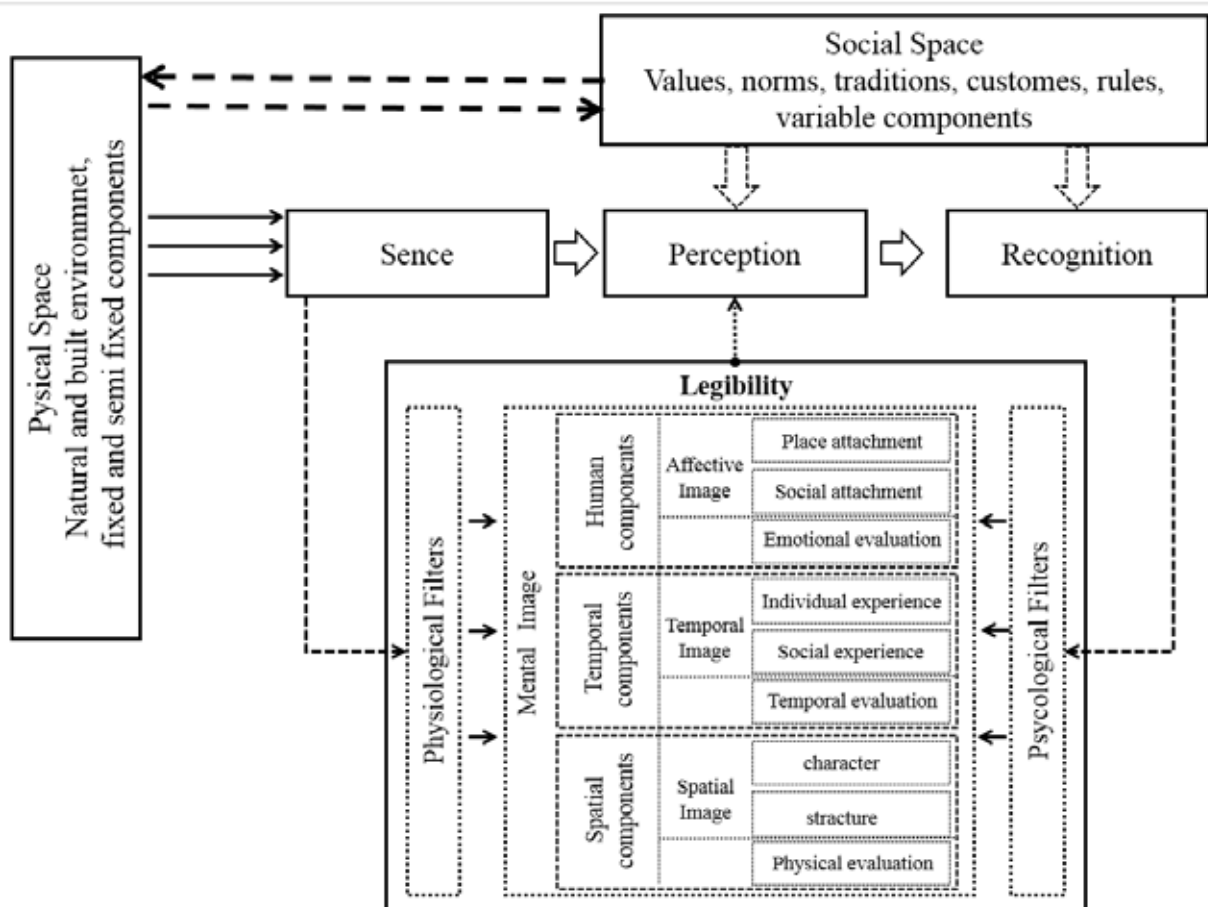

Fig. 2. Conceptual model of the relationship between the mental image and legibility. Source: authors.

are effective on other components both in the form of personal experiences and social events in recording the temporal images and also in the social environment information of values, norms, customs, and rules. In addition, the physical and social environment, as two concepts related to perception and recognition of person from the space are in interaction with each other and have mutual effects.

Conclusion

The evaluation of the extent of the perceived physical legibility only by the evaluation of the spatial-mental image clarity is somehow decreasing the legibility concept to legibility of a space or in other words, it is the objective perspective of the physical environment; while, legibility should be searched in people as a perceptual-mental concept. Although, the people address by their spatial-mental image based on the physical environment characteristics and interaction with others and create its connection with other places, they are relied on temporal – mental images and emotional – mental images in their interaction with the physical environment that somehow are the non-tangible layers of mental image or mental perspective. The temporal – mental image that less been paid attention in the studies related to the legibility somehow creates the relationship of the location to other time periods in the people's mind. This layer of the mental image, is, in fact, the connecting ring of the spatial and emotional images and is not only affected by the time duration of the person's interaction with the place and will also be related to the interaction type and awareness of its background. The people, also based on their temporal – mental image highlight and mark some physical points in the mind that these points are not necessarily the indicative points of the spatial-mental image. The diversity of the temporal – mental images has resulted in the formation of an emotional – mental image for the people. This level of legibility converts it to a

spatial character component which is effective in spatial belonging and feeling.

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