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Exploring Analysis of the Environmental Qualities Affecting the Design of Unmanaged Urban Under-Bridge Spaces

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ABSTRACT

Today, the quality of urban spaces is one of the most important environmental design concerns. The present study aims to present the environmental preferences of users of under-bridge spaces to achieve an appropriate model for the design of these spaces. The study is carried out using two qualitative and quantitative methods. In the first stage, in order to examine citizens' environmental preferences, the opinions of 50 users of urban spaces about abandoned spaces under urban bridges are examined using Quicksort technique[1] and in-depth interviews, and finally, the environmental patterns affecting the design of spaces under bridges are extracted. In the second stage, the environmental patterns obtained from the first stage of the study are examined by the participation of 144 graduates of Architecture, Landscape Architecture, and Urban Design using a questionnaire and by random sampling. Then, the reliability and validity of the questionnaire are assessed and finally, after collecting the data using Confirmatory Factor Analysis (CFA), the model of this study is produced in SPSS Software and Lisrel software. The results indicate that citizens' environmental preferences for the design of spaces under urban bridges are: safety and security, physical cohesion, visibility, vitality, sensory richness, sense of belonging, and climatic comfort. This study also shows that recognizing and understanding the needs of users of space will significantly help to provide better environment to understand and experience higher quality spaces and will provide the necessary theoretical frameworks to environmental designers, especially architects and urban designers.

Keywords: Quality of Urban Space, Environmental Preferences, Abandoned Spaces under Bridges.

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1. INTRODUCTION

Lost spaces in cities are unstructured and abandoned urban landscapes that, in addition to not having safety and security, have been left unused and kept away from pedestrians. These spaces in cities are great potentials that must be returned to the urban arena. Despite the importance of the public territory and its proven impact on various aspects of urban life, the quality of urban spaces in metropolises such as Tehran is rapidly declining. Modern urbanism has caused inefficiency of many spaces and remained them far from the cycle of people's everyday lives by changing the city form. Among all urban spaces, the abandoned in-between spaces have been mostly neglected and become non-places that are forgotten in the city arena. Ignoring these spaces makes them a place for social anomalies, while leading to the wasting of a large part of urban lands that could be allocated to the public territories (Razaghi & Onsori, 2015). In-between spaces are an important part of urban spaces. But the designers' inattention and weakness in proper understanding of such spaces cause them to be ignored and turned into abandoned spaces. But the new urban territory does not appear only in ordinary urban spaces, but is often developed within and around the in-between spaces such as the edge of intersections where there are different urban territories (Hajer & Reijndor, 2001). Unmanaged spaces under bridges are among these spaces and have the potential to become pedestrian or shared spaces. These spaces are uninhabited lands around highways, underpasses, and overpasses that designers pay less attention to their maintenance and use and are often not used appropriately. In addition, lack of security and fear of violence have caused many urban spaces to not be able to play a positive role as an arena of social interactions in practice (Ibid, 2001).

2. THEORETICAL FOUNDATIONS

Rogers Trancik defines abandoned spaces as: those parts of public spaces that need to be redesigned and have no positive relationship with the surrounding environment and the users (Trancik, 1986). To classify contemporary urban spaces, Carmona also considers the urban under-bridge spaces, that are often left unused and abandoned, as low-managed urban spaces (Carmona, 2010).

The Project for Public Spaces (PPS) Organization identifies four basic factors for assessing the success of public spaces: access and linkages, comfort and mental image, uses and activities, and sociability (Project for Public Spaces Organization).

Since the science of urban design "considers one of the definite tasks of urban designers to be attracting the people's attention to how they experience the public arena of cities, urban design needs to pay special attention to the quality of being experienced of places by different groups of users" (Golkar, 2012).

According to Golkar, quality of urban design is the result of three forces (components): functional quality, experimental-aesthetic quality, and environmental quality of cities. He has introduced qualities such as permeability and movement, mixed-use, universal design, quality of public space, climatic comfort, safety and security, fit and vitality of behavioral settings, and flexibility under the functional component, qualities of legibility, visual proportion, sense of time, sensory richness, personalization, and being educative under the aesthetic component, and qualities of supporting the ecosystems, energy-efficiency, and environmental cleanness under the environmental component (Golkar, 2008).

In the environmental preferences approach, the terms "Socio Fugal Space" and "Socio Petal Space" refer to spatial qualities that separate people or bring people together, (Osmond, 1957). Paying attention to "environmental preferences" and evaluating them have a significant impact on the perception of space users and how one space is preferred to the other. People judge their environment and thus respond appropriately to the environment. According to Kaplan, preferences are considered as a criterion for aesthetic judgments and this is a complex process which is associated with the perception of it and reaction to it in terms of usefulness and supportiveness (Kaplan & Kaplan, 1989). Kaplan and Kaplan (1977), in a study entitled "Patterns of Environmental Preference" emphasized the use of a questionnaire to examine people's environmental preferences of urban spaces. They call the questionnaire "Environmental Preference Questionnaire (EPQ)" in which there are some questions on people's preferences, for example, the sentence "Thing I like…." which must be completed. The second method used by Kaplan and Kaplan is Visual Quality Classification or Quicksort Method (Kaplan, 1977). In their study, they introduced environmental preferences in the form of four characteristics of coherence, identifiability, complexity, and mystery, and considered them as features that give us the information about the environment and help people to show their preferences for specific physical environments. Coherence (meaning that the environment makes sense) and complexity (meaning that the environment encourages humans to engage with the environment) are important to recognize the environment rapidly. In a longer period of time, identifiability and mystery encourage the discovery of the environment (Kaplan & Kaplan, 1982).

Also, regarding the subject of environmental preferences, Herzog, in his study entitled "Cognitive Analysis of Preference for Urban Spaces", introduced five categories of urban spaces (open-undefined, well-structured, enclosed settings, blocked views, and corridors) to evaluate preferences, and on this basis, introduced nine predictor variables including spaciousness, refuge, enclosure, coherence, identifiability, complexity, mystery, typicality, and age for examining people's environmental preferences. To classify urban spaces, according to Stephen Kaplan,

he used the two components of openness and spatial definition as the criteria, and finally, by analyzing the given scores and spatial preferences, he placed the variables in three general categories: 1) spaciousness, refuge, and enclosure variables (which have affected spatial preferences in none of the analyses of this study), 2) the three variables of identifiability, mystery, and typicality (which have been effective in some analyses), and 3) coherence, complexity, and age variables (which have played an effective role in preferences of urban spaces). Thus, according to this study, it can be said that urban spaces with good organization and sufficient diversity are attractive for people and most preferred by them (Herzog, 1992).

Irizarry (2003), in a study entitled "Restructuring the Spaces under Elevated Expressways", argued that the construction of a highway has some effects on the surrounding urban areas that should be considered. These effects are: physical form, social and psychological effects, visual and environmental effects, land use, economic conditions, displacements, and safety (Irizarry, 2003).

By identifying the problems of urban bridges, the study by Razaghi and Onsori (2014) in Iran pointed out the spatial potentials of overpasses in the form of 1) location (being located at the intersection of important urban streets) in the presence of individuals and social interactions, 2) Physical form (inducing a unique sense of space) with elements of roof, floor, wall, climatic comfort, sense of shelter, and sense of pause and stop, and 3) use (various facilities in the form of use due to the existence of different scales and high frequency in the city). In addition, they considered pollution and lack of security as the major problems of these spaces (Razaghi & Onsori, 2015).

3. METHOD

The present study is a mixed methods research was carried out using different stages of qualitative and then quantitative methods. In the first stage of the study, in order to obtain the users' preferences for unmanaged spaces under urban bridges using methods such as in-depth interviews and Visual Quality Classification (Quicksort) technique, the qualities and key principles affective in the regeneration of abandoned spaces were extracted in the form of some components. The second stage of the research was performed using the questionnaire developed based on the components obtained from the first stage. The reliability and validity of this questionnaire were assessed and then, the results of data collection were presented as a model using confirmatory factor analysis.

3.1. The First Stage of Research: Qualitative Study

The qualitative study was carried out to identify "people's environmental preferences for the design of the abandoned spaces under urban bridges" by developing the questions listed in Table 1 in accordance with EPQ method proposed in the Kaplan and Kaplan's study entitled "Patterns of Environmental Preference" and then using in-depth interview method to communicate with the interviewees as well as applying Q-Sort method in the time period from August to November 2016. For the interviews, 20 persons were selected by targeted sampling method and with maximum variety. The in-depth interviews was begun with the general question of "How would you like the under-bridge space to be like to use it?" and then, their preferences for these spaces were asked to achieve more design details. The interviews lasted 20 to 25 minutes. Data collection was continued until data saturation. The sample selection criterion was to consider both genders (male and female) in various age groups, who were present in unmanaged urban under-bridge spaces in the cities of Tehran and Mashhad. All the interviews were digitally recorded, and then written and analyzed by qualitative content analysis method to extract the related themes and concepts. To increase the validity of qualitative research, the concepts were extracted from the written interviews by two urban designers. Ethical principles were also observed, i.e. the written consent was obtained from the participants and the data from interviews were used anonymously.

Table 1. In-Depth Interview Questions in the Qualitative Stage of Research

1. What do you like about this place?
2. What do you dislike about this place?
3. How do you feel when you enter this space?
4. What do you often use this space for?

Then, in order to validate the results of the in-depth interview, four sets of images were prepared in A4 pages considering different goals in line with urban design qualities such as climatic comfort, sensory richness, vitality, safety and security, etc. to assess people's preferences for a desirable urban space using the Q-sort method, and then distributed among 50 people aged 15 to 60 years in the urban under-bridge spaces in Tehran and Mashhad. The respondents were asked to prioritize the images based on their own preferences, from the highest preferred to the lowest preferred. Participants in this study were those who have used the place at least weekly.

Fig. 1. The Sets of Images Used in the Q-Sort Method

3.1.1. Results of the First Stage

According to the in-depth interviews, the contents of data collected from field studies were examined to assess people's preferences for under-bridge spaces as urban spaces and it was attempted to analyze the desirability and undesirability of these spaces from the people's point of view. According to the mentioned analyses, the most important issue that most people agreed on is the lack of safety and security, especially at night which is due to some reasons such as lack of adequate lighting, dark and hidden corners, fear of street molestations, fear of the high velocity of cars, and so on. The second issue was the lack of attention to visual beauties, which is primarily due to the use of concrete materials in the construction of bridges, which leads to a lifeless atmosphere, and also in most cases, after construction, the bridge is left alone and no arrangements are made for its beauty. Regarding the expectations, most of the participants have firstly referred to lighting and beautification of the bridge walls (use of bright colors and different materials such as colored tiles and use of vegetation to cover the rigidity of the bridge piers, etc.).

In addition to assessing the preferences of individuals extracted from the in-depth interviews, in the Q-Sort method, four sets of images, each with different goals including: individuals' general perceptions of urban under-bridge spaces (the first set of images), social preferences in the form of public art (the second set of images), space flexibility and use of temporary uses (the third set of images), and climatic comfort, especially the use of vegetation in urban under-bridge spaces (the fourth set of images), were considered and according to the aforementioned analysis, factors such as easy pedestrian access, cleanness, proper lighting, appropriate urban furniture, use of color and light, creating diversity in the space, service uses such as commercial use for meeting daily needs, social interactions, safety and security, etc. were considered as the significant qualities affecting people's preferences. Finally, in order to make the results obtained from the above methods more practical, the results were summarized in the form of design qualities and principles in Table 2. It should be noted that the classifications in the table below were developed based on the opinions of the scholars mentioned in the "literature review" section, especially the components and qualities of urban design from the viewpoint of Koroush Golkar.

Table 2. The Qualities Extracted for the Revitalization of Unmanaged Urban Spaces According to the Space Users' Environmental Preferences, Using the Interview Method and Q-Sort Method

Safety and Security	1. Controlling vehicles at the pedestrian-vehicle interactions 2. Use of natural elements in creating safety 3. Geometric modification of access network 4. Use of traffic calming strategies 5. Social surveillance 6. Presence of night activities 7. Proper lighting 8. Elimination of hidden places

Visibility	9. Harmony in the type and material of urban furniture and green space 10. Multiple pedestrian accesses to the space 11. Presence of outstanding elements 12. Paying attention to specific architectural elements 13. Recognizing and strengthening existing functions
Physical Cohesion	14. Harmony in physical elements 15. Presence of formal unity 16. Unity in the created micro spaces 17. Perceivable rhythm 18. Type and color of the materials 19. Paying attention to the use of symbolic elements
Vitality	20. Diversity of body and function 21. presence of spatial rhythm 22. Presence of natural elements 23. Flexibility in the acceptance of various uses 24. Human scale and pedestrian-priority space 25. Facilities for pedestrians
Sensory Richness	26. Visual proportion 27. Paying attention to night lighting 28. Presence of temporary uses in relation to hearing and olfactory senses (perfume sales, broad bean sales, etc.)
Sense of Belonging	29. Considering public art and a design pleasant for the youth 30. Attracting the participation of people in locating the uses 31. Considering the identity of the site
Climatic Comfort	32. Cleanness (reducing air, noise, and environmental pollutions) 33. Comfort in terms of micro climate 34. Optimal controlling of climatic factors 35. Protection of pedestrians from weather conditions

3.2. The Second Stage of Research: Survey

The second stage of the study was performed using the survey method and a questionnaire. To explain these questions, the components obtained from the first stage using interview and Q-Sort methods were used as the basis, and finally a questionnaire consisting of 7 dimensions and 35 items (results of studies in the first stage of the research) was developed using the environmental preferences of users of urban under-bridge spaces. Then, the participants (students and graduates of Master and PhD's degree in Architecture, Landscape Architecture, and Urban design) were asked to score each item from 1 to 5. Finally, after determining the validity and reliability, the questionnaire was validated by 144 participants. To evaluate the reliability of each component of the Environmental Preference Questionnaire, Cronbach's alpha coefficient was calculated using SPSS 22 software, as listed in the table below.

Table 3. Cronbach's Alpha Coefficient of the Environmental Preference Questionnaire Developed for the Users of Urban Under-Bridge Spaces

Questionnaire	No.	Components	Cronbach's Alpha	Result
Environmental Preferences in the Design of Urban Under-Bridge Spaces	1	Safety and Security	0.88	Reliable
	2	Visibility	0.67	Reliable
	3	Physical Cohesion with the Context	0.78	Reliable
	4	Vitality	0.83	Reliable
	5	Sensory Richness	0.75	Reliable
	6	Sense of Belonging	0.72	Reliable
	7	Climatic Comfort	0.85	Reliable

According to the table above, the Cronbach's alpha values of all the components used are higher than 0.7. Therefore, it is concluded that the scores obtained from these questionnaires are reliable and accurate. In the next step, the study was conducted as a survey and finally, the confirmatory factor analysis method was used for the 7-component environmental preference model.

The second stage of the study was conducted in the time period from January to April 2017, with participation of 144 students and graduates of Master and PhD's degrees in Architecture, Landscape Architecture, and Urban Design from various Iranian universities. The participants were selected from the participants in Future City conference at Iran University of Science and Technology in order to have the most diversity by

random sampling method. The results obtained from the Environmental Preferences Questionnaire were confirmed by the factor analysis. In the present study, in order to examine the correlation between the questions and components of the Environmental Preferences Questionnaire and to determine the variance of each of the indicators, confirmatory factor analysis was used by applying the AMOS software. To report the results obtained on the validity of the study, first, the fit index was presented. In the following, the standard coefficients, non-standard coefficients, standard and non-standard errors, coefficient of determination, t-test, significance level, and path diagram of each of the studied variables are presented.

3.2.1. Results of the Second Stage

To measure the fit index of the model using the LISREL software, a series of indicator are provided to measure the goodness of fit index and consistency of the developed model. In general, there are two indices for testing the model fit: 1) indices of goodness, 2) indices of badness.

Indices such as Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), and Normed Fit Index (NFI) are of the good indices. The larger the value of these indices (higher than above 0.9), the better the fit of the model. Indices such as $\chi 2$ (chi-square)/df ratio and Root Mean Square Error of Approximation (RMSEA) are of the bad indices. The smaller their value, the better the fit of the model. The allowable $\chi 2$/df ratio is 3 and the allowable RMSEA is 0.08. In order to examine the fit of the model, it is necessary to examine goodness and badness indices, some of which are explained below. The value of chi-square is affected by the number of samples. If the sample size is more than 200, this index highly tends to increase. Therefore, analyzing the fit of the model with this index is usually reliable in samples of 100 to 200.

Table 4. Fitness Indices Calculated for the Environmental Preferences Model Developed for Designing Urban Under-Bridge Spaces

Index	Statistical Indices of Fitness	Symbol	Criterion	Value
Badness	Chi-square	x2	P<0.01, d. f= 608	1030.32
	Chi-square/ df. Ratio	x2/df	< 3	1.67
	Root Mean Square Error of Approximation	RMSEA	≤0.08	0.08
		RMR	≤0.08	0.059
Goodness	Normed Fit Index	NFI	>0.9	0.63
	Goodness of Fit Index	GFI	>0.9	0.67
		AGFI	>0.9	0.62

The values of the fitness indices calculated for the environmental preferences model developed for designing urban under-bridge spaces are listed in Table 4. As the significance level calculated for the Chi-square/df ratio is lower than 0.01, the theoretical model is not fit with the observed data. As mentioned, if the sample size exceeds 200, the value of Chi-square tends to increase a lot. Therefore, in such cases, Root Mean Square Error of Approximation (RMSEA) can be suggested to analyze the fit of the model along with the Chi-2square/df. Ratio index. As the values of RMSEA and RMR are less than 0.08 and also the Chi-square/df. Ratio is less than 3, it can be said that the model has a good fit. Based on the results of Table 4, other fitness indices (goodness indices) calculated for the model such as NFI, GFI, and AGFI are close to the desired criterion of 0.9. Based on these indices, it can be said that the model has a good fit.

In summary, considering the values of goodness and badness indices, the fit of the theoretical model with the observed data is confirmed. Table 5 shows the standard and non-standard coefficients, error, coefficient of determination, t-test, and significance level. Standard coefficients show the effect of each factor in explaining the variance of each item. Non-standard coefficients are equivalent to non-standard regression coefficients. The standard error is equal to the square of the standardized regression coefficients minus one. T-test is equivalent to the non-standard regression coefficients/ non-standard error ratio. The significance level of the t-test lower than 0.05 means that the question can be predicted by the latent factor. The factor loads and error rates of each research question can be seen in path diagrams. It should be noted that the significance level of all items is lower than 0.01, meaning that all the seven components extracted from the qualitative stage in the survey and the quantitative stage are confirmed. In the next step, the standard coefficients show that the sub-criteria of each component, which are in the form of research items, are confirmed.

Table 5. Summary of the Results of Confirmatory Factor Analysis of the Qualities Affecting the Design of Urban Under-Bridge Spaces

Component	Question	Mean	SD	Coefficients		Error	T-test	Sig.
				Standard	Non-Standard			
Safety and Security	9	3.3	0.9	0.77	1.00	0	0	0
	8	3.3	0.9	0.77	0.92	0.11	8.58	0.001
	7	3.3	0.8	0.82	0.93	0.10	9.29	0.001
	6	2.9	1.0	0.77	1.07	0.13	8.58	0.001
	5	3.1	1.0	0.71	0.95	0.12	7.78	0.001
	4	3.0	0.8	0.67	0.74	0.10	7.32	0.001
	3	2.9	0.9	0.42	0.51	0.12	4.13	0.001
	2	2.5	0.8	0.50	0.59	0.11	5.30	0.001
	1	3.0	1.0	0.65	0.85	0.12	7.01	0.001
Visibility	6	2.4	0.9	0.61	1.13	0.22	5.15	0.001
	5	2.3	0.9	0.58	1.05	0.21	4.99	0.001
	4	2.5	0.9	0.57	1.00			
	3	3.0	0.8	0.54	0.83	0.18	4.70	0.001
	2	2.7	0.8	0.44	0.70	0.18	3.97	0.001
	1	2.7	0.8	0.30	0.47	0.16	2.87	0.004
Physical Cohesion with the Context	4	2.5	0.8	0.56	1.00			
	3	2.5	0.9	0.73	1.39	0.25	5.50	0.001
	2	2.5	0.8	0.66	1.17	0.23	5.15	0.001
	1	2.4	0.8	0.75	1.33	0.24	5.56	0.001
Vitality	6	2.9	0.9	0.71	1.00			
	5	3.2	0.9	0.72	0.99	0.14	7.23	0.001
	4	3.1	0.9	0.71	1.00	0.14	7.19	0.001
	3	3.0	0.8	0.53	0.69	0.13	5.33	0.001
	2	2.7	0.9	0.72	1.10	0.15	7.29	0.001
	1	2.9	0.9	0.66	0.96	0.15	6.62	0.001
Sensory Richness	5	2.7	0.9	0.79	1.00			
	4	2.4	1.0	0.45	0.62	0.13	4.66	0.001
	3	2.6	0.8	0.58	0.64	0.10	6.19	0.001
	2	3.1	0.7	0.61	0.61	0.09	6.56	0.001
	1	2.9	0.8	0.69	0.73	0.10	7.63	0.001
Sense of Belonging	4	2.8	0.9	0.59	0.85	0.15	5.53	0.001
	3	2.9	1.0	0.67	1.00			
	2	3.0	0.8	0.62	0.82	0.14	5.82	0.001
	1	2.7	0.9	0.62	0.83	0.14	5.81	0.001
Climatic Comfort	3	3.1	0.9	0.73	1.00			
	2	3.1	0.9	0.84	1.14	0.14	8.42	0.001
	1	3.3	1.0	0.86	1.25	0.15	8.61	0.001

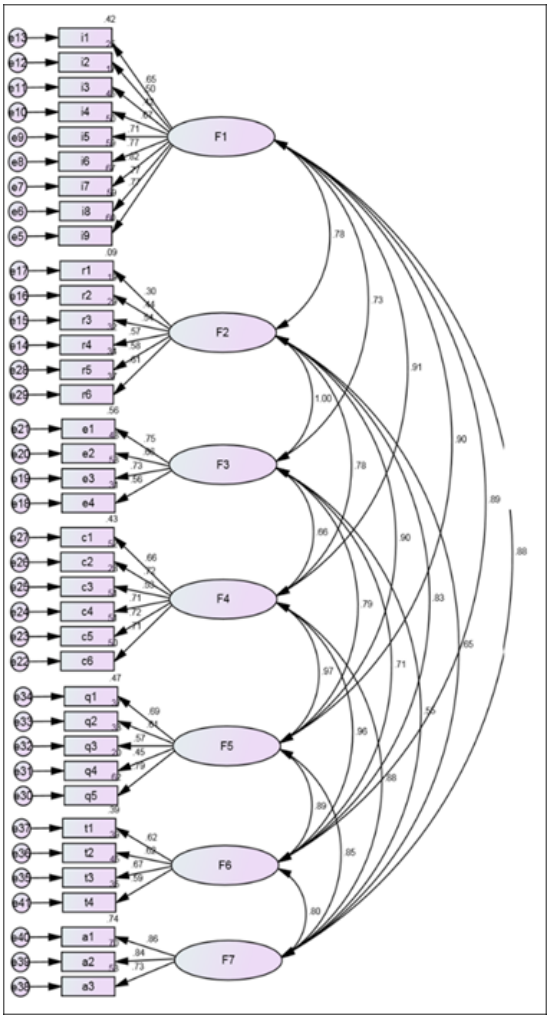

Fig. 2. Path (1) of Standard Coefficients and Coefficient of Determination of the Qualities Affecting the Design of Urban Under-Bridge Spaces

Therefore, standard coefficients are reported in Figure 2. For example, the standard coefficient of question 1 in the safety and security factor is 0.65. Therefore, the coefficient of determination of this question is 42% $(65)^2 \times 100 = 42$). The value of the coefficient of determination is between 0 and 100 that with approaching to 100, the value of variance explanation becomes greater. So, the coefficient of determination of the first question is 42% and thus, 42% of the variance of this question can be explained by the first factor. The error rate of this question (i.e. the amount of variance of the question that cannot be explained by the factor) is 58%. It is clear that the lower the amount of error, the greater the correlation and coefficient of determination between the question and the relevant factor. According to the standard coefficients of the items, the presence of the items as the sub-criteria forming each component is confirmed.

4. DISCUSSION AND CONCLUSION

In the present study, the factors of desirability and non-desirability were examined from the participants' point of view in two qualitative and quantitative stages. Based on the study results, seven environmental factors were developed based on the preferences for the design of the lost spaces. These factors include: safety and security, visibility, physical cohesion with the context, vitality, sensory richness, sense of belonging, and climatic comfort. This study used a mixed research method to explain the model, making it possible to analyze, recognize, and evaluate the urban design qualities affecting the characteristics of urban space such as the factors affecting environmental perception of urban space on the one hand, and to test the possible hypotheses related to the environmental preferences of urban space users on the other hand. In addition, one of the advantages of the method used in this study is that the main design preferences are addressed based on the socio-cultural and environmental characteristics, making it possible to remove the caused by lack of references and previous studies by generalizing the preferences through surveys with experts. These factors, which are shown in the model of environmental qualities affecting the design of urban under-bridge spaces in Figure 3, need to be validated by referring to global studies.

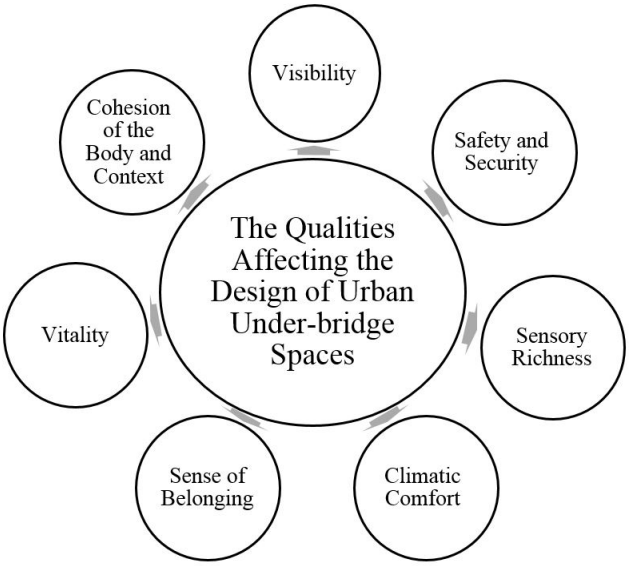

Fig. 3. Model of Environmental Qualities Affecting the Design of Urban Under-Bridge Spaces

- Safety and Security: One of the most important features playing a role in improving the environmental qualities perceived by the users of urban spaces is safety and security. Most people consider this space to be a space without social surveillance. According to Carmona who considers the under-bridge spaces as unmanaged urban spaces, the aforementioned issue should be considered and the need for safety and security is one of the main needs of these spaces (Carmona, 2010). In addition, one of the requirements of a comfortable and imageable urban space is safety and security (Project for Public Spaces Organization). Meanwhile, measures such as providing safety and security and controlling of vehicles at pedestrians-vehicle intersections, use of natural elements for the provision of safety, geometric modification of access network, and use of traffic calming strategies, social surveillance, night activities, and proper lighting are also important (Lak & Ramezani, 2018).

- Visibility: The possibility of seeing the under-bridge space clearly and removing obstacles to understanding this space are other factors mentioned by the participants in this study. Other studies have introduced visibility as having a clear mental image of the space (Project for Public Spaces Organization). Visibility is provided by the presence of harmony in the type of urban furniture and green space, multiplicity of pedestrian accesses to the space, presence of outstanding elements, attention to specific architectural elements, recognizing and strengthening the existing functions, and harmony in physical elements. Meanwhile, the presence of a specific architecture plays a very important role in having a clear mental image (Irizarry, 2003; Herzog, 1992).

- Physical Cohesion: Such spaces, if integrated with the surrounding texture and context (physically and architecturally), can lead to the users' more appropriate understanding of environmental quality. Similar studies on the aesthetic preferences for the street landscape have also mentioned the presence of physical cohesion in street urban spaces as one of the factors effective in the aesthetic perception of the street landscape (Weber, Schnier, & Jacobsen, 2008; Herzog, 1992). The integration between the abandoned under-bridge spaces and street urban spaces becomes important in achieving a uniform urban space in the perceptions of the totality of urban space and eliminating island-type feeling. The possibility of integrated and holistic understanding of the environment by the users can be provided through the presence of harmony in physical elements, presence of formal unity, unity in the created micro spaces, perceivable rhythm, type and color of the materials, attention to the use of symbolic elements, and diversity of body and function. This study shows that the presence of harmony in architectural style is also of special importance compared to other factors. It is worth mentioning that physical coherence along with readability and legibility of urban spaces are among the necessary qualities for designing good urban spaces (Bentley, Alcock, Murrain, McGlynn, & Smith, 1985).

- Vitality: Lack of activity causes desertedness and unattractiveness while preparing the space with temporary uses and activities such as street peddling, art shows and presence of artists can help to increase the attendance of people. On the other hand, not paying attention to maintenance of bridges, lack of proper pavement, and environmental pollutions such as graffiti and inappropriate advertising, as disturbances, make the space unattractive for people. Vitality is one of the essential qualities of urban space design that is provided through the diversity of activities and attendance of people (Ibid, 1985). In the viewpoint of the participants, providing vitality is possible through the diversity of body and function, presence of spatial rhythm, presence of natural elements, flexibility to accept diverse uses,

human scale and pedestrian-priority space, facilities for pedestrians, and visual adaptation in the design of under-bridge spaces. Meanwhile, the diversity of body and function and having diverse uses and activities have the greatest effect in providing compatibility, as confirmed by previous studies (Irizarry, 2003). In addition, the presence of the proposed and existing uses in the context of the bridge is also important (Razaghi & Onsori, 2015).

- Sensory Richness: Another demand of people for designing under-bridge spaces that can be used in landscaping is the presence of the quality of "sensory richness". The presence of eye-catching images through murals can enhance visual attractiveness, and the presence of water can stimulate people's sense of hearing. Creating various pavements using different materials helps to stimulate the sense of touch. In addition, the presence of vegetation in the landscaping can stimulate the sense of smell and thus increase environmental attractiveness for them. Studies by Bentley et al., in the book entitled Responsive Environments, also emphasize the importance of quality of "sensory richness" and use of all the senses in urban space (Bentley et al., 1985). Meanwhile, the presence of temporary uses in relation to the senses of hearing and smell (perfume sales, broad bean sales, etc.) has the greatest impact (Razaghi & Onsori, 2015), because these activities with environmental attractions can attract people.

- Sense of Belonging: According to the users of urban spaces, the presence of features providing a better perception of beauty and better environmental understanding of the space makes the space different from other spaces; and due to their uniqueness and high environmental quality in the minds of citizens, they create a sense of belonging. The presence of visual elements such as public art, along with landscaping, promotes a sense of belonging to a specific urban space. Sense of belonging can generally be considered as the result of pleasure qualities in urban space, which have been previously mentioned as a factor for the environmental urban space assessment by Jack Nasar (Nasar, 2011). Sense of belonging can be achieved by considering public art and designs pleasant to the youth, attracting the participation of people in locating the uses, and paying attention to the identity of the site. Having a unique identity for under-bridge spaces is one of the most important features in creating a sense of belonging (Irizarry, 2003).

- Climatic Comfort: The permanently shaded space under the bridge is often cold due to the temperature difference with the surrounding environment which is mainly the result of air current and makes it difficult for people to be present in that space. A design which is able to warm the space and eliminate the annoying winds can guarantee the more presence of users in the under-bridge spaces. According to PPS studies, the quality of environmental comfort is one of the requirements for creating a successful urban space (Project for Public Spaces Organization). This will be provided by cleanness (reduction of air, noise, and environmental pollutions), comfort in terms of micro climate, optimal controlling of climatic factors, and protection of pedestrians from weather conditions, among which the cleanness is the most important according to the participants in the study.

According to the results of this study, it seems that recognizing and understanding different needs of urban space users, especially those spaces less addressed in the design of urban projects, need methods that can examine the environmental ideas required in creating urban spaces. The implications of this study can help urban designers and landscape architects to design the abandoned urban under-bridge spaces.

END NOTE

1. Visual Quality Classification (Quicksort)

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