

GRADE SEPARATION: ITS EFFECT ON THE PUBLIC PERCEPTION OF URBAN LANDSCAPE. CASE STUDY: HAMEDAN, IRAN

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Abstract: Urbanization has brought about dramatic changes in the quality of the landscape in Hamedan, which is located in a mountainous area in the west of Iran. Not only these changes affect the people's well-being, but also how they perceive the new landscape. This paper analyses the effects of newly built grade separations on the public perception of the urban landscape. In keeping with this aim, the survey was a suitable method to collect the people's opinions on the quality of the urban landscape. Unity, complexity, order, and aesthetics are the main factors that affect the quality of the urban landscape and its perception. The structural equation model of the research showed that unity through aesthetics is the critical path that affects the people's image of the city and their landscape preference. The results confirm that the public perception of the landscape quality, which is essential to planners, is affected by different kinds of intersection. Additionally, it specifies that the unique structure of Hamedan and its development in the last decades has a significant role in the people's landscape preferences and on their perception of it.

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Introduction

Urbanization is the most dynamic process that shapes the landscapes at a global level, therefore urban landscapes are home for more than 50% of the world population. In the opinion of Palermo (2008), landscape is the place of individuality to which the habitants belong. Azara (2008) noted in his study that landscape is not something to exist in itself, as it is just a mental construct. According to Konkoly-Gyuró (2018), transformation is one of its characteristics. Rędzińska and Szulczewska (2019) mentioned that the change of landscape is an unavoidable process. Zhang et al. (2019) described the urban landscape as experiencing rapid growth all over the world. Also, it is something that is regarded to be of exceedingly fragmented habitats (Malkinson et al. 2018).

Urban landscapes are the result of social development and environmental transitions (Wu et al. 2019). Also, many researchers have investigated the importance of cognitive and identity approaches in landscape research (Silbernagel et al. 2006, Tieskens et al. 2018, Suppakittpaisarn et al. 2019). For instance, Memlük (2012) believes that it is not completely independent from the circumferential buildings and structures. Altogether, they shape the character and identity of a city. Urban landscape contributes to the view of a city in connection with the visual quality (Memlük 2012). As mentioned by Nijhuis et al. (2011), the visual aspects are themselves characters of the landscape, including: unity (the landscape as an entire, its individuality and clarity of character and boundaries); spaciousness (the spatial figure or spatial organization, the spatial layout); and appearance (the thorough set of sensory impressions, especially 'seeing').

Antrop and Van Eetvelde (2017) described "visual perception" as the information that we sense. Gavrilidis et al. (2016) stated that landscape quality assessments are usually based on visual perception. Additionally, landscape perceptions refer to the visual aspects and the use-value of the environment (Soini et al. 2012). Chen et al. (2009) mentioned in their study that the personality of the observer, the location of observation, the socioeconomic profile of the observer, the scene composition, and the complexity of the landscape affect its perception. According to Hedblom et al. (2020), "visual quality" is something linked to scenic beauty, aesthetic quality, and visual preference.

Mathew and Krishna Rao (2007) described intersections as areas shared by two or more roads. Qiu and Peng (2015) divided them into three types: at-grade intersections, grade separations, and interchanges. Grade separation is classified into two types: overpass and underpass (Mathew and Krishna Rao 2007, Qiu and Peng 2015, Modi 2017). An overpass is a road that crosses over another road, and an underpass is an underground passage (Mathew and Krishna Rao 2007, Modi 2017).

The characteristics of the landscape in grade separations have a significant impact on

the quality of the urban landscape and its perception (Figure 1). Here we address questions such as: how does the urban landscape alters where the kind of intersection is changed? How does it affect the public perception of the urban landscape? What are the reasons for it? What are the factors that affect people's preferences in any grade separation?

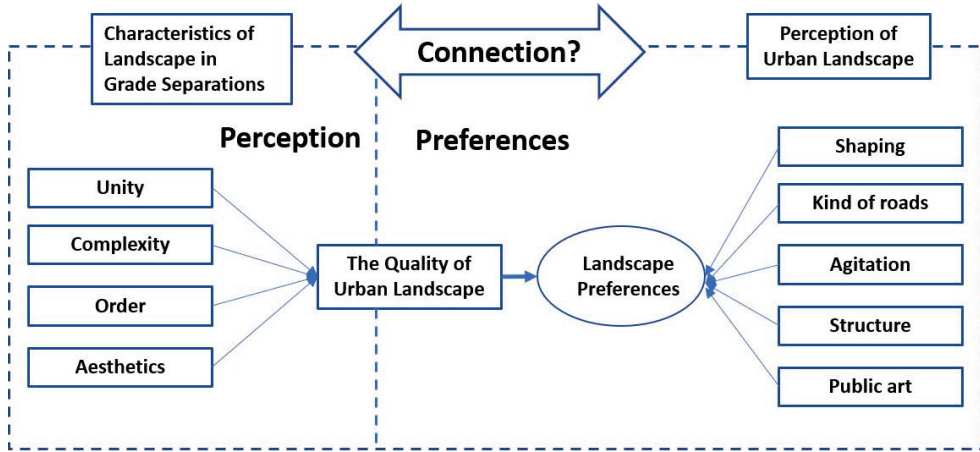


Figure 1. The characteristics of the landscape in grade separations

In this paper, regarding the rapid change in the quality of the landscape, the characteristics of the landscape in grade separations are investigated. The focus is on discovering the relationship between these changes and their impact on the people's perception in Hamedan City in the West of Iran. Hamedan is chosen for this study because its landscape, as a scenic city located in the hillsides of Alvand, which is a subrange of the Zagros Mountains in western Iran, is changing rapidly over the past decade on the account of various reasons, such as urbanization (Solgi et al. 2016).

The primary purpose of this study is to discuss the effect of grade separations on the quality of the landscape and its perception in cities such as Hamedan. As regards the characteristics of the landscape in grade separations, the results have positive and negative interests on the people's perception of the urban landscape. For example, as a negative interest, overpasses have blocked the pedestrian's view, but a positive one is that they have caused different sequences of pleasant vision for drivers.

Methodology

The area selected for this study was Hamedan municipality, located in a mountainous region in the west of Iran (Figure 2), and the capital city of Hamedan province. Hamedan City is one of the oldest cities in Iran. As stated by Kanō (1978), it had been touched by the wave of urban modernization in the days of Reza Shah. That time, in 1931, the German engineers had planned six radial roads for Hamedan. Then, the

second wave of urban modernization in the 1970's was introduced in the city. Also, it has developed somewhat in recent years; for instance, nine grade separations were constructed in the different places of the city (Figure 3). Based on the latest census of 2016, the population of Hamedan is of 554 406 people. In Hamedan, winters are usually cold and snowy, and summers are mild.



Figure 2. The location of Hamedan in Iran

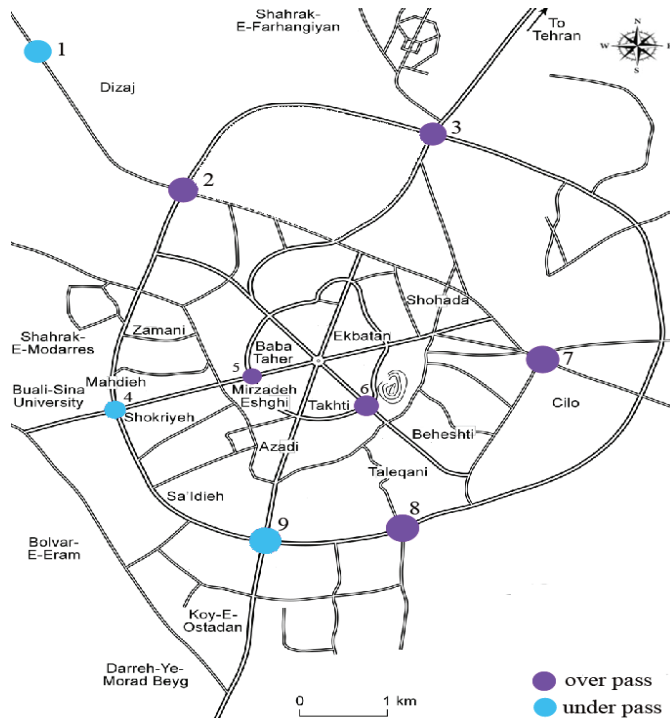


Figure 3. Plan view of the streets of Hamedan and the location of its grade separations

Study population and sampling

Following the aim of the research, the people who reside in Hamedan were involved in the study. The sample was above ten years old. At the 2016 census, the number of people who are ten plus years old and reside in Hamedan was 475,054. The methods of sampling and calculating the sample size were random and empirical. Referring to this method, the sample size involved 0.023% of the target population (110 people).

The dependent variable in this study is the landscape preference, which refers to the perception of it (Figure 4). Preference is described as an interaction between thought and effect (Van Der Heide and Heijman 2013). The independent variables are unity, complexity, and order. These variables are chosen based upon prior studies illustrating their association with the perception of the urban landscape and the relevance of each variable concerning a particular concept (preference).

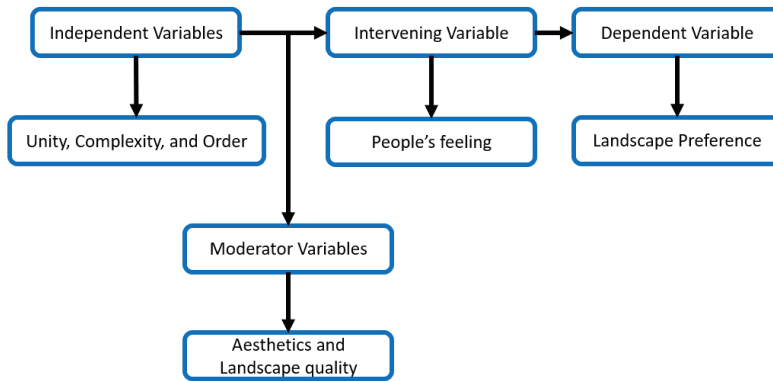


Figure 4. Research variables

Data collection

For data collection, the questionnaire was used to gather the necessary information about the effects of the different kind of intersections on the quality of the landscape and its perception. Also, it was used to find the connection between unity, complexity, and order as independent variables, and landscape preference as a dependent variable. The field application of the questionnaire used as a data collection tool in the research was carried out in October 2018. Before completing the questionnaire, the researchers gave detailed information about the study to the participants. Questions were multiple choice closed-ended ones. Two types of questions were used; the first type was designed to know about the participants like their age, gender, etc. The second type of questions was designed to the analysis of the landscape quality effects on the participants' perception and their preferences, following the variables of the research and the Likert scale (Joshi et al. 2015). A five-point scale was used to know how much the people agree or disagree with a particular status. The responses ranged from

strongly agree (5 points) to strongly disagree (1 point). The questionnaires were distributed on paper and social networking.

Method and tool of statistical analysis

The structural equation modeling was used for analyzing the structural model of the research. Civelek (2018) described this method as a statistical method used to test the connections between the observed and latent variables. The observed variables are the measured variables in the data collection process and the latent variables are the variables measured by connecting to the observed variables because they cannot directly be measured. Structural Equation Modeling consists of two primary components as the structural model and measurement model. SmartPLS was employed to analyze the data in this research. Wong (2013) described it as one of the prominent software applications for Partial Least Squares Structural Equation Modeling (PLS-SEM).

Results

Factor loading, validity, and reliability

To study the model, the factor loading of research questions were investigated. The values that are upper than 0.4 are valuable, and the ones that are lower than 0.4 should be removed. According to this, the questions with a factor loading lower than 0.4 were removed. Content Validity and Convergent Validity were also used for validating the validity of the measurement tool (questionnaire). Content Val was achieved by ensuring the consistency between the measurement indexes and the existent literature; this validity was gotten by the opinion of experts. Convergent Val is based on the medial correlation coefficient between the indexes of any construction. The Average Variance Extracted (AVE) should be greater than 0.5, which makes it possible to assess Convergent Val (Fornell and Larcker 1981). The composite reliability coefficient was used for ascertaining the reliability of the tool. According to Ali et al. (2018), Composite Reliability (CR) should be higher than 0.7.

The results revealed that the model and the tool have suitable reliability and validity (Table 1). It seemed that there is a significant connection between these variables:

1. unity, aesthetics, and landscape preference
2. complexity, aesthetics, and landscape preference
3. order, aesthetics, and landscape preference
4. unity, aesthetics, landscape quality and landscape preference
5. complexity, aesthetics, landscape quality and landscape preference
6. order, aesthetics, landscape quality and landscape preference

Table 1. The values of ascertaining the reliability and the validity of the tool

Variable	AVE	CR
Unity	0.638	0.776
Complexity	0.517	0.705
Order	0.580	0.805
Aesthetics	0.511	0.712
Landscape quality	0.580	0.723
Landscape preference	0.668	0.801

Hypotheses testing

T-value was used for testing these hypotheses and the connection between the variables in the structural model. In SmartPLS, that is noticed by bootstrapping. T-statistic shows the effect of variables on each other. The values of more than 1.96 show that there is a significant connection between the variables. Also, path coefficients should be used for testing the intensity of this connection. If the path coefficients are more than 0.6, the variables are in a strong connection; the values between 0.3 and 0.6 and under 0.3 show moderate and weak connection, respectively (Figure 5, Figure 6). The t-test value for unity and aesthetics was 3.309; the results showed a significant connection between these variables, and the path coefficient value for them was 0.389. Besides, there was a significant connection between aesthetics, landscape quality, and landscape preference variables because the t-test value for them was 3.540, which is reliable (Table 2).

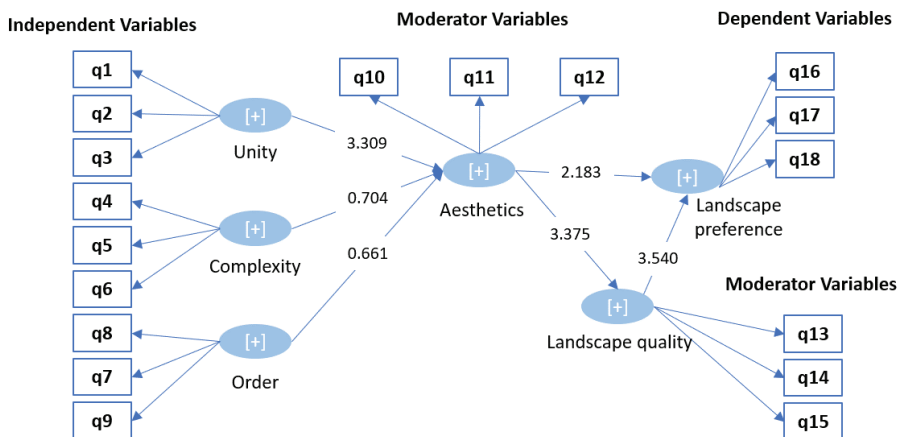


Figure 5. The results of the t-statistic

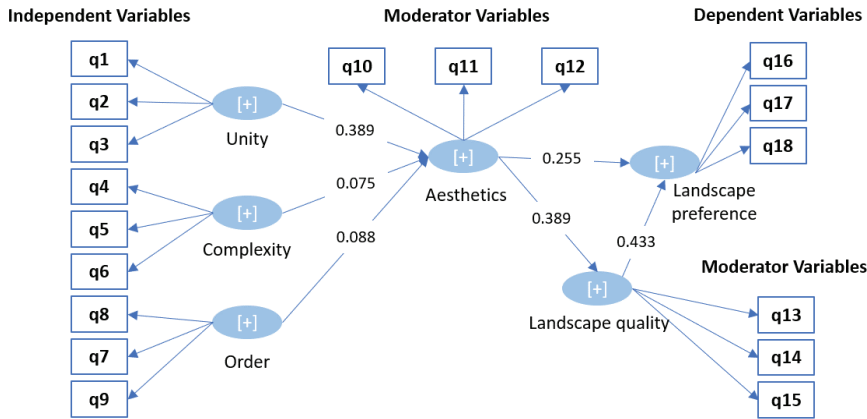


Figure 6. The results of the structural coefficients

Table 2. The reliable paths

Path	Path coefficient	Condition
unity > aesthetics > landscape preference	0.099	✓
unity > aesthetics > landscape quality > landscape preference	0.168	✓

Model Fitness

The Coefficient of Determination (R^2) was used to evaluate the fitness of the structural model. Chin (1998) defined the R^2 value as 0.19, 0.33, and 0.67 for weak, moderate, and strong in the Partial Least Squares (PLS) path modeling method. The average value of R^2 in this research is 0.338, which shows the power of the structural model for describing the structure. Finally, the results show that the produced model has a suitable fitness.

Discussion

In this research, the hypothesis of the study states that there is a significant connection between the characteristics of the landscape in grade separations and the quality of the urban landscape and its perception. Using the example of Hamedan, the results indicate that not only grade separations have significant effects on the quality of the urban landscape, but also, they have effects on the people's perception and their landscape preferences. These include the variation in the quality of the urban landscape because of the characteristics of the landscape in grade separations. Additionally, the correlation between unity and aesthetics indicates the typical qualities of these two factors that lead to the landscape preference.

There are several ideas and theories of the landscape perception and preference that confirm the results of the study. Kaplan and Kaplan (1989) described coherence as the degree to which different elements relate to each other and facilitate insight and create order. Based on their description and the results of the study, the unity between the elements of grade separations is such an essential factor that should be considered.

Nohl (2001) believes that landscape is seen as an aesthetic object and characterized by its appearance so that aesthetics is something that affects people's perception and their landscape preference in grade separations.

As mentioned above, unity through aesthetics is the critical path that affects the people's image of the city and their landscape preference. The findings of this issue in Hamedan show the fact that creating the image of unity in grade separations has an impact on the people's understanding of their landscape preference and on their perception of aesthetics.

According to the results of the interviews, it seems that the location of Hamedan (in a mountainous area that provides a beautiful landscape) affects the people's preferences and it causes them to prefer the landscapes that are parallel and compatible with this special feature. Although most of the grade separations located in Hamedan are non-aligned with these landscapes, which can be an annoying thing for the people and it affects their perception, the grade separations located in the second ring of the city cause a sense of coherence in this area and they have a positive impact on the unity of this structure and then its feature of aesthetics.

Additionally, it seems that the next reason about the effect of unity on the landscape quality and landscape preference, which impacts on the people's perception of the landscape, is to consider the previous local identity of Hamedan. This claim is confirmed by reviewing the history of urban development in the city, which included 6 radical roads in 1931 (Zakerhaghighi et al. 2014). This urban modernization has changed the special structure of the city and it caused the people's image of the urban spaces to change (separated spaces without any special connection).

According to the history of urban development in the city and the results of the research, the grade separations are the urban spaces that have affected the special structure of the city. Also, they have caused the people's perception of the urban landscape which is gradually changing. This is important to mention that only two of the grade separations are located in the first ring of the city.

As stated in many environmental psychology studies (Lalli 1988, Radstrom 2014), the physical and environmental characters of a city affect the shaping of people's local identity. All in all, the people of Hamedan know the grade separations as spatial connections between the different spaces of the city, and unity as one of the characters

of grade separations that affect the quality of the urban landscape, their preferences, and their perception.

Although all the data in this paper are from only one city, the methods of analysis of the landscape quality on people's perception may be applied to cities worldwide. This suggestion is supported by preliminary results from European cities like London, Paris, Rotterdam, and Frankfurt am Main, all of which focus on the evolution of landscape and its impact on the public opinion (Nijhuis et al. 2011).

Conclusions

The analysis of the connection between the characteristics of the landscape in grade separations and the quality of the urban landscape and the people's perception shows that the affective factors in grade separation, which affect the quality of the urban landscape and its perception, are those that cause unity and aesthetics to be perceived as well as with considering of the visible landscapes of the city. Also, it is specified that changing the special structure of Hamedan in 1931 has caused the people of the city to perceive the grade separations as connecting factors that connect the physics of the city. The same characters of the grade separations are the things that have caused unity as a factor to affect the quality of the urban landscape and the people's perception of it.

The main limitation of this study was related to the sample size and the sample area selection, as well as the potentially high level of providing biased results. It is recommended that the research to be done in the future with particular emphasis on the connection between age, gender, occupation, and landscape preference in grade separations because people from different ages, genders, and occupations have different opinions about their environment.

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