



Investigating the Effect of Tall Buildings on Tehran City Landscape

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ABSTRACT: Tall buildings despite their different features and impacts are just defined by their height. The main problem of defining tall buildings in cities in terms of urban landscape is that this definition does not have an appropriate relativity, and only includes the investigation of tall buildings based on their height. Applying the criteria for locating, architecture and height of tall buildings in cities without considering the mutual impacts of tower and urban landscape and with relying on physical aspects and ignoring environmental impacts of buildings has developed more problems for the appearance of cities. In this study we investigated the factors affect the role of tall buildings on landscape of Tehran city in Iran. In the current study, the dependent variable was the urban landscape of Tehran, and the independent variables were related to the semantic, aesthetic and visual aspects. Accordingly, the hypotheses of this study predict whether there is a relationship between tall buildings and urban landscape based on the semantic, aesthetic and visual aspects. To do so, we selected northern urban views of Tehran. Statistical population consisted of all families living in northern parts of Tehran. Of this, a sample of 168 subjects was selected using Cochran formula. Data collection tool was a 5-point likert type questionnaire. Collected data from participants were analyzed in SPSS software. According to the results, tall buildings of urban landscape of Tehran have a moderate status. From the perspective of people, the strongest effects of such buildings are respectively related to four factors of meaning, scale, view and identity.

Keywords: Tall Buildings, Urban Landscape, Semantic, Visual Impact, Meaning, Tehran City.

INTRODUCTION

Construction of tall buildings based on the modern meaning began in Iran in 1951. First, tall buildings were constructed by foreign investors because of their profitability. Then, in next decades, the construction was continued due to other reasons such as showing governmental and economic power, and providing housing for low-income classes of the society. In the following years, the Islamic revolution, the construction of tall buildings was continued as completing the unfinished projects during the war and after that. After the war days, the boom in the construction of tall buildings was quickly continued again profitability and made such buildings turn into a model of residents' social superiority. The largest numbers of tall buildings in Iran are located in Tehran where there are a large number of buildings which have been constructed due to the increasing housing

demand on the one hand and the profitability in different periods on the other hand. The main problem of defining tall buildings in Tehran in terms of urban landscape is that this definition does not have an appropriate relativity, and only includes the investigation of tall buildings based on height. Tall building has a relative concept which should contain other factors playing role in such buildings in addition to height. For this reason, the definition of tall building in the city can be a combination of qualitative and quantitative variables. For example, in some regions of UK, the height-based definition of tall buildings influences on the surrounding environment or affecting the skyline considerably. If a building has one of the aforementioned conditions, it can be considered to be a tall building. Therefore, the definition of tall buildings in Tehran can be as follows: if a building meets one of the following conditions, it can be considered to be a tall building.

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- Having more than 12 stories;
- Having a tangible impact on the skyline and view corridors or on the meaning of the surrounding environment due to its height.

The problems about tall buildings in Tehran can be categorized into the following main parts:

(1). Functional: in terms of function, tall buildings should be investigated in terms of different aspects such as the relationship with the effect of historical setting, relationship with the transport system, participation in public spaces facilities, the impact on immediate environment, participation in the environment legibility, accordance with the principles of sustainability, etc. unfortunately, currently, no attention is paid to the decision-making on the location and architecture of tall buildings. One another problem which has been developed due to confusion in the growth of tall buildings is the loss of views and urban landscapes by constructing towers in inappropriate places. In this regard, no serious attention has been paid to the importance of natural and urban views in Tehran.

(2). Aesthetics: Despite the importance of tall buildings in terms of aesthetic in urban environments, there is no clear criterion for measuring this type of buildings in terms of Aesthetic in Tehran and Iran. However, tall buildings can affect the city strongly due to their proportions, and have a considerable positive or negative effect on cities in terms of aesthetic.

(3). Identity: tall buildings have a considerable effect on landscapes both in terms of shape and semantic. Tall buildings as the symptoms of a city carry meaning. That's why; extra attention should be paid to the quality of architecture and location of such buildings. Unfortunately, tall buildings in Tehran have neither sufficient quality of architecture, appropriate location, nor necessary values in terms of meaning and identity.

Currently, applying the criteria for locating, architecture and height of tall buildings in Tehran without considering the mutual impacts of tower and urban landscape and with relying on physical aspects and ignoring environmental impacts of buildings have developed more problems for the appearance of Tehran. The aim of this study is to identify the problem correctly and analyze its scientific dimensions such as to be able to present an accurate report on the status of tall buildings construction in Tehran, and their effect on its view.

MATERIALS AND METHODS

Meaning in Urban Landscape

Ferdinand de Saussure and Charles Sanders Peirce are pioneers of semiotics. According to de Saussure, a Swiss linguist and semiotician, semiotics is a science that studies the role of signs as part of social life. The sign is completely arbitrary—i.e., there was no necessary connection between the sign and its meaning. According to him, there is a tripartite relationship: signifier + signified = sign.

Peirce defined semiosis as an irreducibly triadic process wherein something, as an object, logically determines or influences something as a sign to determine or influence something as an interpretation or interpretant, itself a sign, thus leading to further interpretants. De Saussure use the term “sémiologie” and Peirce used it as “semiosis”. According to Morris (1971) semiotic is divided into 3 sections: syntactic, semantic, and pragmatic relations. Syntactic rules may determine which combinations of signs may function as grammatical statements. Semantic rules may determine the conditions under which signs may be applicable to objects or to situations. Pragmatic rules may determine the conditions under which sign-vehicles may function as signs.

Keller (1988) stated that urban semiotics is the study of meaning. In fact, semiotics is a kind of discovering physical shapes and their attributed meanings as an intermediate of world of signs and symbols. Barthes (1970) introduced elements of semiotics as: axes of language, signs, motivation, and denotation and connotation. According to him, semiotic analysis involves two operations: dissection and articulation. Dissection includes looking for fragments (elements) which when associated one with another suggest a certain meaning, and articulation involves determining the rules of combination. Jamalpour (2005) divided semiotics into the six following categories:

- Biosemiotics
- Ecosemiotics
- Social Semiotics
- Cultural Semiotics
- Visual Semiotics
- Pictorial Semiotics

There are different methods to understand the meaning of ambient environment most important of which are: Three-factor theory of emotion developed by McAndrew (1993), and semantic differential-type scale by Osgood et al (1957).



Aesthetics and Meaning

According to the theory, suggesting that beauty depends on the audience's eyes, meaning and beauty cannot be distinguished, and there is a relationship between them. Beauty is a subset of meaning and all kinds of beauty carry meaning but all of the meanings are not beautiful and some of them just seem beautiful (Mansouri, 2000). The course of development of three concepts of architecture (function-form-meaning) has been begun since the Vitruvian's time till the late twentieth century i.e. Capon's time. Capon (1999) found several similarities between beauty and meaning. While studying the course of development of meaning in architecture; he accurately investigated the course of conceptual development of meaning in the last decade. According to Capon, meaning includes concepts such as harmony, wisdom, culture, volume, style and etc. therefore, it becomes clear that meaning and beauty can be distinguished very hard. The border between meaning and beauty can be determined for the researches conducted in the field of beauty. It should be noted that there are different ideas on explaining the relationship between meaning and beauty. For example, in information theory, numbers of definitions are given for meaning and beauty, as follows:

- Semiotics information: the information lacks aesthetic value but conveys specific meaning and concept to the audience' mind, and teaches him or her particular thing.
- Aesthetic information: the aesthetic information brings satisfaction, which is caused by mental and social factors, and is a function of the individual who receives information (Groter, 1987 cited by Lonard, 2000).

As it is clear from the definitions, meaning and beauty do not have a common aspect, and none of them is the subset of another but they are defined such a way that they can be quietly distinguished from each other.

Baumgarten (2007) distinguished between logical truth and aesthetic truth. Certainly, the aesthetic truth is formed based on a logic named logical truth. So, aesthetic cannot be judged based on the true or false but the individual expresses it based on terms such as attractive and boring, or pleasant and unpleasant. In addition to the classification presented above, Lang (1987) divided aesthetic into two main parts in relation to the artificial environment based on the aesthetic types proposed by Santayana (1995). His classification included formal aesthetics and symbolic aesthetics. In the first type of the aesthetics, meaning and semiotics were discussed, and in the latter type, visual attractiveness was considered considerably.

Nohl (2001) proposed four levels of landscape

aesthetics to solve the problem of distinguishing meaning from beauty. The four levels are:

- **Perceptual level:** at this level, the observer immediately gains the relevant information through the senses of sight, hearing and smell. For example, the observer can distinguish a woodland landscape from other types of landscape.

- **Expressive level:** at the level, all perceived elements and structures are associated with the observer's feeling. For example, mountain looks magnificent or forest looks weird and fear-inspiring.

- **Symptomatic level:** at the symptomatic level, physical things of the landscape refer to something beyond themselves. Objects are understood as signs or symptoms indicating something else.

- **Symbolic level:** at the level, visible things in landscape indicate something else. The difference between this level and the previous one is that however, the contents, attached to the indicating or symbolizing things, are not landscape realities, as they are at the symptomatic level. Here they are become ideas, imagination, utopian pictures, which are generated in the head of the observer. For example, a natural lake covered by grasslands may be an image of peaceful, easy life. The first and the second levels proposed by Nohl (2001) are considered to be levels of cognition, and the third and the fourth one are related to semiotics. By such categorization, he aimed at examining aesthetics in two parts including cognition and perception.

According to conducted studies on the aesthetic impacts of tall buildings on the urban context (Health et al., 2000; Daniel 2001; Zacharias 1999; Naser et al., 2001 and Stamp 2002), it became clear that factors such as Physical complexity in the building, height ratio of tall buildings related to landscape backdrops such as mountains in the backgrounds of urban landscape, and skyline model created by tall buildings are some of the effective factors in the aesthetics of tall buildings in the urban context.

The Visual Impact of Tall Buildings on Urban Landscape

According to London View Management Framework 2009, for assessing the impact of high-rise buildings, following factors should be referred:

- i. "The scale, grain and massing of the proposal in relation to the existing townscape;
- ii. Its appearance and materials (including texture, colour, scale and reflectivity);
- iii. The effects on the skyline;
- iv. The obstruction of existing views and any loss of



views to the identified landmarks;

v. The visual relationship of the proposal to its setting and surroundings;

vi. Night-time effects/lighting, including aviation and other lighting, and their impact on the landmarks and the viewing experience generally;

vii. Seasonal changes, weather conditions and any shadowing from other buildings.” (Greater London Authority, 2009)

The visual impact of the high-rise buildings on landscape can be in different forms. This impact can be negative or positive. Being positive or negative in impact can be based on location, scale, construction quality, and other similar factors. The positive impact in general means the creation of a privileged position in the city by high-rise buildings, such as improving the city character or better readability of the urban environment. The negative effects of high-rise buildings can be also due to obstruction of the city view or weakening the city character because of low quality construction or poor design of the buildings. There are different methods in analyzing visual impact of high-rise buildings on urban landscape which are summarized below:

i. GIS-based visual analysis methods: methods such as visibility, a measure of the distance at which an object or light can be clearly discerned, visual dominance analysis as the ratio between the high-rise building's depicted image area divided by the area of the film frame, which corresponds to the high-rise building's visual area divided by the area of the object frame (Rod and Van Der Meer, 2009), or visual impact modeling based on size, color, and the lightness contrast between the object and its surroundings (Bishop, 1997).

ii. 3D-based View Analysis methods: methods such as visual impact analysis for visibility and visual importance (Gross, 1991); or Hough transform concerned with the identification of lines in the image and identifying positions of arbitrary shapes (Duda and Hart, 1972).

iii. Measuring impacts on view corridors.

METHODOLOGY

This study is a qualitative research. In this study, the survey method was used considering the situation. According to the research goal and characteristics, the statistical population was consisted of families in north of Tehran divided into four groups: The first group included the individuals, living in places where the images of landscapes were prepared. The second group comprised those who live in a place where has an economical level as same as the first group but the images of landscapes are not related to where they live. The third group is

those who live in places with lower economical level in comparison with that of the places where the first and the second groups live, and the taken images do not belong to where they live. The participants of the latter group were selected from among those with a degree higher than bachelor in architecture. Figs 1-4 show the images used to investigate the effect of high-rise buildings on Tehran landscape. Some views were selected from the north of Tehran, because tall buildings in north of Tehran have greater impact on the surrounding environment (the mountains), and it is possible to examine their impacts on natural backdrops. In this study, systematic sampling method was used to select sample size. For this purpose, with respect to the numbers of households, living in the north of Tehran, a sample of 168 individuals was selected using Cochran formula. The required data were collected using a structured questionnaire. The questionnaire comprised six 5-items, based on Likert Scale ranging from very low =1, low = 2, average = 3, high = 4 and very high = 5. The first three questions were about the sociological characteristics, the question 4 was about the visual components of tall buildings, the question 5 concerned the aesthetic components of the buildings, and the latter question was about the semantic components of the buildings. SPSS software was used to analyze data collected from participants. In the current study, the dependent variable was the urban landscape of Tehran, and the independent variables were related to the semantic, aesthetic and visual aspects. Accordingly, the hypothesis of this study predict whether there is a relationship between tall buildings and urban landscape based on the semantic, aesthetic and visual aspects.



Fig. 1. A Single Tall Building in the Context of Tehran (www.skyscrapercenter.com)



RESULTS AND DISCUSSION

Descriptive Statistics

First, respondents were asked to express their opinion about the appropriateness of tall buildings. The answers are presented in table 1. Based on the evaluation, 23.8, 48.2, and 28% of respondents answered that respectively, the buildings are at very appropriate, average and very low levels. The mean value of the questions 1-5 was 2.95 which means in total, towers were at an average level of pleasantness.

Table 1. Statistics Data about the Appropriateness of Tall Towers in Tehran

Score	Frequency	Percent	Cumulative Percent
High	40	23.8	23.8
Average	81	48.2	72.0
Low	47	28.0	100.0
Total	168	100.0	
Mean Value: 2.95			

Mean values and standard deviation of the studied variables are presented in table 2.

Table 2. Statistics Data for the Studied Variables and Subscales

Variables	Subscales	N	Mean	SD
Aesthetic	Scale	168	3.26	1.01
	Shape	168	2.80	0.947
	Color	168	3.08	0.777
Visual	View	168	3.09	1.01
	Appearance	168	3.47	0.781
	Skyline	168	3.62	0.939
Semantic	Identity	168	3.24	0.807
	Meaning	168	3.19	0.953
	Semiotics	168	2.98	0.804



Fig. 2. Clustered High-Rise Buildings in the Context of Tehran



Fig. 3. A Tall Building with Designed Crown in Tehran

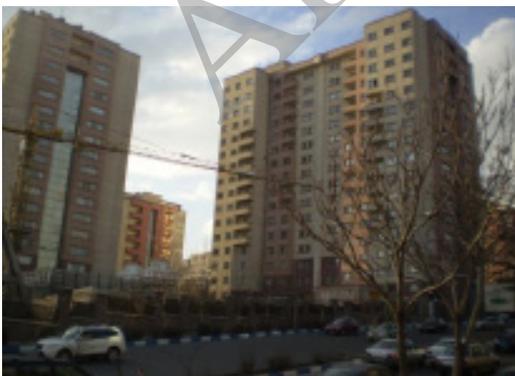


Fig. 4. Tall Buildings without Designed Crown in Tehran.



Inferential Statistics: Testing Hypotheses

After collecting data, in this section, the research hypotheses are investigated. To this end, multiple regression analysis was used.

The Relationship between Tall Buildings and Urban Landscape in Terms of Aesthetics

Table 3 shows descriptive statistics of two variables. In table 4 and 5 we present test results of their relationship.

Table 3. Estimation of the Correlation between the Components of Aesthetics

Components	R	Sig
Scale	0.467	0.000
Shape	0.237	0.000
Color	0.355	0.000

According to table 3, considering the p-value <0.05 and Pearson correlation coefficient, it can be concluded that there is a correlation between the components of

aesthetics and urban landscapes at 99% confidence level. The highest correlation is between the component of scale and urban landscape. The related correlation coefficient is 0.467.

Table 4. Model Summary for the First Hypothesis

Model	Multiple Correlation Coefficient (R)	The Coefficient of Determination (R ²)	Adjusted Coefficient of Determination	D-W
1	0.545	0.297	0.284	1.828

Durbin-Watson statistic should be between 1.5 and 2.5 to meet the independence condition of the errors. According to table 4, the value for Durbin-Watson statistic is equal to 1.828. So, the assumption of the error

independency is confirmed and regression analysis can be used. Also, in table 4, the coefficient of determination is almost 0.3. In other words, tall buildings affect urban landscape in terms of aesthetics as 30%. Regression coefficients for these variables are presented in table 5.

Table 5. Regression Coefficients for the First Hypothesis

Variable	Standardized β	T	Sig
Scale	0.407	6.021	0.000
Shape	0.054	0.767	0.444
Color	0.262	3.776	0.000

Based on table 5, according to standardized coefficients (β) (what the regression coefficients would be if the model were fitted to standardized data) as well as t-statistic, it can be understood that all predictor variables have a pure and significant effect and they are predictors of dependent variable. In this regard, the component of

scale with a β of 0.407 has the highest predicted effect on the urban landscape.

The Relationship between Tall Buildings and Urban Landscape in Terms of Visual Impact

Table 6 shows descriptive statistics of two variables. In table 7 and 8 we present test results of their relationship.

**Table 6. Estimation of the Correlation between the Components of Visual**

Components	R	Sig
View	0.539	0.000
Appearance	0.295	0.000
Skyline	0.303	0.000

According to table 6, it can be said that there is a correlation between the visual components and urban landscape at a confidence level of 99%. From among all

the components, the component of view has the highest value of correlation equal to 0.539

Table 7. Model Summary for the Second Hypothesis

Model	R	(R ²)	Adjusted R ²	D-W
1	0.554	0.307	0.294	1.827

According to table 7, Durbin-Watson value is equal to 1.827, and the coefficient of determination for the independent variables is almost 0.3. In other words, tall

buildings affect urban landscape in terms of visual impact as 30%. Regression coefficients for these variables are presented in table 8.

Table 8. Regression Coefficients for the Second Hypothesis

Variable	Standardized β	T	Sig
View	0.550	6.711	0.000
Appearance	-0.116	-1.259	-0.197
Skyline	0.147	1.893	0.060

Based on table 8, according to standardized coefficients (β) and t-statistic, it can be understood that all predictor variables have a pure and significant effect and they are predictors of dependent variable. In this regard, the component of view with a β of 0.550 has the highest predicted effect on the urban landscape.

Investigating the Relationship between the Semantic Components and Urban Landscape

Table 9 shows descriptive statistics of two variables. In table 10 and 11 we present test results of their relationship.

Table 9. Estimation of the Correlation between the Components of Semantic

Components	R	Sig
Identity	0.546	0.000
Meaning	0.693	0.000
Semiotics	0.553	0.000

As it can be seen in table 9, there is a correlation between semantic components and urban landscape at 99% confidence level.



Table 10. Model Summary for the Third Hypothesis

Model	R	(R ²)	Adjusted R ²	D-W
1	0.719	0.517	0.508	2.122

According to table 10, Durbin-Watson statistic is equal to 2.122 and coefficient of determination is almost 0.51.

It can be said that tall buildings affect urban landscape in terms of semantic as 51%. Regression coefficients for these variables are presented in table 11.

Table 11. Regression Coefficients for the Third Hypothesis

Variable	Standardized β	T	Sig
Identity	0.275	3.972	0.000
Meaning	0.515	6.311	0.000
Semiotics	0.215	3.172	0.000

Based on table 11, according to standardized coefficients (β) and t-statistic, it can be understood that all predictor variables have a pure and significant effect and they are predictors of dependent variable. In this regard, the component of meaning with a β of 0.515 has the highest predicted effect on the urban landscape.

CONCLUSION

In this paper we tried to study the effect of tall buildings on Tehran landscape in Iran. Participants in this study were 168 members of families living in northern part of Tehran. Using a questionnaire, we investigated their opinion about appropriateness of tall buildings in this city. According to their point of view, these buildings were at an average level of pleasantness. To investigate the relationship between tall buildings and urban landscape, three main factors of visual impact, semantic and aesthetic were examined for tall buildings in the city based on three hypotheses analyzed in SPSS software. According to the results, we concluded that the highest effects of such buildings are respectively, related to the subscales of meaning, scale, view and identity.



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