Visual Effects of Vertical Gardens in Landscape Designs: A Case Study of Düzce University Campus

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Abstract

In recent years, the urban landscape designs directed different searching bring something to forefront some concepts based on ecological and aesthetic such as the "Vertical Garden, Roof Garden, Rain Gardens". In this context, a number of the wall, building facades and open green spaces, in the campus of the Düzce University, produced different planting design strategies in developing alternative designs by these surfaces. Then, these designs were evaluated by campus users. To this end, some photos in these three areas were taken and visualized according to natural and systematical concepts of planting design and elements. Then, a questionnaire was realized to users of the campus. As a result, it is determined that what kind of planting design strategy that campus users give an importance in terms of aesthetic and solid walls are provided both aesthetic and ecological restoration.

1   Introduction

The rapid rise of urban population in fast developing countries in the world and growth of cities causing the increase land values more results with built high and dense constructions. It is accepted that this reformation of cities like that is the main cause of decreasing green areas and a lot of environmental problems. While the green areas like urban parks, gardens where the urban residents under physiological pressure of the built environment can feel relaxed are decreasing, and at the same time sustaining their daily life in the border of the buildings, streets and pavements, urban residents left apart from the natural environment. The subjects like natural resources usage and their future, environmental problems and global climate changes are increasing the awareness of "green" in built environment and leads the studies on building cities with natural environment conditions (AYDIN İPEKÇI & YÜKSEL 2012). During last years, it is determined more integrated approaches in the planning and the design procedures of urban spaces that also involving plants, and "Green Infrastructure" concept, will support plant designs planned on more fundamental principles, has been evolved as sewage, water, electricity and communication infrastructures (ACAR et al. 2007). The concept of green infrastructure is not a new concept however it is a new term. It has a long, 150 years history. At the beginning of this period, it is based on "Green Networks" idea. Green Infrastructure; is multifunctional green area system bolstered the high quality natural and artificial environment of the sustainable environment. The basic principle is the protection, the improvement and the management of the local landscapes. BENEDICT & MCMAHON (2002) remarks the importance of the green infrastructure (ACAR et al. 2007); *It protects the diversities of ecological, social and economic functions; it*

improves habitat and biodiversity; it keeps the natural landscape processes original; it cleans water and air;it provides recreational activities; it creates healthy environment; it provides a satisfactory connection between nature and perception of the sites.

During all the historical time, the precedents can be found about the growing plants on facades and balconies aiming protection of either esthetical values or air quality to get the benefits mentioned above. BASS & BASKARAN (2001) on their study; give place to the precedents of ornamenting the Roman's mausoleums with Pompeii tradesman's ivy grown in their balcony, and of covering the facades and roofs with grass by Wikings. It can be found the precedents of vertical gardens in the houses of Indian and Spanish, in Mexico during 16th and 17th centuries, in Russia and other countries were one of the parts included the Union of Soviet Socialist Republics, and 18th century France. At the end of the 20th century, there was a rapid increase rate of the applications on planting the constructions together with the sustainability concept. Especially, it has been applied on the new built constructions. When it is considered how large the facades' total area of high and dense building constructions in cities, it can be suggested that the usage of planted facades system's for greening the cities is a rational strategy (AYDIN İPEKÇI &YÜKSEL 2012). At the beginning of the projects, the surfaces of the roofs and courtyards were used, however because of the space of the facades were larger than the others, if these surfaces greening would be more profitable for not only the building but also environment researched with many different studies. In the study done in Toronto University, a sample vertical garden built and it is searched out the result that the energy consumption decrease of air circulation, energy consumption and cooling system (BASS & BASKARAN 2001; AYDIN İPEKÇI &YÜKSEL 2012). It is also called that "The Green Skins" because of greening roof and facade-like a coveredge of plant. The greening provides lots of benefits, too. The researches approved; green skins are an important heat instrument as an isolation component. As an example of this usefulness, Turf Houses can be shown in Iceland where they are also exist nowadays. These houses can be good examples to observe the benefits of heating performances by greening house's surfaces like roofs and walls. The benefit of vertical greening has been summarized by ÖRNEK (2011): *To decrease the energy consumption by increasing buildings thermal performance; to decrease urban heat island effect; to increase the interior air quality; decrease the noise pollution.* The possibility of being an esthetic value the environment taking part daily life and understanding the importance of this value based on the existence and effectiveness of human being in interaction of individual and environment forced to add the concept of visual element into the existing environmental elements. The reality of being the opportunities increasing the environmental esthetic value by utilizing land and create artificial structures, during the process of planning and designing the environment, besides the cost-benefit analysis necessary for control of improvement requires the analysis of new instruments: environmental visual qualities (AK 2010). The quality of landscape can be evaluated in consideration with the preferences and decisions. Preference is the though based on the experience of personal likes. According to KAPLAN (1978), when the evolution period is considered, preferences are strongly connected with the fundamental necessities. The other words, preferred environments are the locations where individuals has ability of intervention and can be satisfied more on their needs. Nowadays, the solutions of environmental planning and design is very closely related with the evaluation of its subjective and objective qualities (AK 2010) so visual quality concept defined is one of the most instruments to measure and utilise the esthetic values. According to DANIEL (2001), the analysis of the visual quality analysis is the land

use assessment method has been using for many years. Two assessment methods have been examined in general. Expert approach is based on the environmental management applications. Perception approach on the other hand, is based on the perception and researches. The specialty that distinguishes these approaches is the way of defining interconnected landscape qualities. Both of them are interested in the visual esthetic quality of landscape (DEMIRCI 2010).

2 Material and Method

2.1 Study area

The research carried out has been a vertical garden potential of Düzce University. There are limited arranged areas in the city, which was the most important element effecting the selection of sample area negatively. The province Düzce, which is the research field and is located between the 400 40′ – 400 47′ north altitude and 310 21′ – 310 26′ east longitudes, is situated in the North West part of Turkey and in the Blacksea region. It shows the climate of western part of Blacksea and Mediterranean Macroclimate as well as the climate of Marmara region. Winters are snowier than the real Mediterranean climate and freezing often occurs. The research field has a characteristic of large-based plain with a little slope; large part of this region consists of alluvial soil (MANSUROĞLU 1997; KESIM 1996).

2.2 Materials

The walls of Düzce University consist of the main material of this study. The photos of the walls were used as the questionnaire material. Photos are visualized by computer to determine the two planting design concepts (color and line), which were taken from Duzce University Campus (Figure 1).
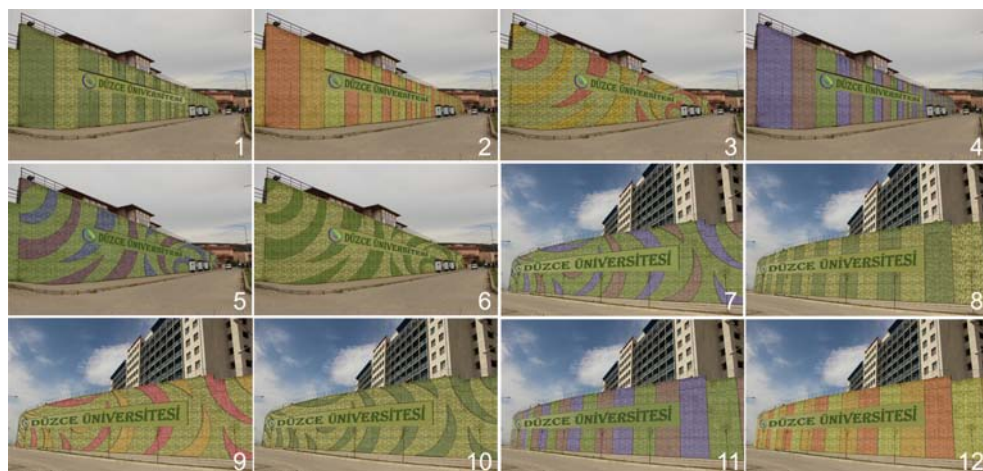
Fig. 1:   Vertical photos used in questionnaire

2.3   Methods

The questionnaires were administered to the students, staffs and visitor of Düzce University, Düzce Campus. Totally, 90 questionnaires were carried out in November 2013. A method developed by OSGOOD et al (1957) was called "Semantic Differential Scale Technique" or "Semantic Differential Technique". In this method, opposite adjective pairs are determined and these adjective pairs are offered to the subjects with a scale. The questionnaires were performed by visual evaluations of the photograph groups transferred to the computer one by one by reflecting by means of a projector. While realizing the questionnaire, some adjective groups (beauty-uniqueness-naturalness-harmonious-call to mind-resting-perceptible-visual effect-coherence-sustainable-variety-complexity) were evaluated as well as some design elements (color-form-texture). In the questionnaire, each determined adjective pair was evaluated as 5-point as -2,-1, 0, 1, 2. In addition, in order to determine if there is a difference in the questionnaire according to the socio-economic structures of the subjects, the subjects were asked about their residences, incomes, gender and the school they attend. The data were analysed using the SPSS (Statistical Package for Social Science) 15.0 statistical package (ACAR et al. 2003; EROĞLU 2004; EROĞLU et al. 2006; ACAR et al. 2007; ALKAN et al. 2009; EROĞLU 2012 and EROĞLU et al. 2012).

3   Results

According to descriptive statistics, 32% of the participants were male, 68% were female, 33,3% were students, 33,3% staff, and 30% visitors of Düzce University. In addition, 71% of the participants are in age group 21-25. Their income levels: 50% is between 500-1000 TL (Turkish Liras).

As determined the statistics (ANOVA), photo number 3 has the highest scores of beautifulness, uniqueness, harmonious, perceptible, coherence, sustainable, variety, color, form, texture and visual effect. Moreover, the highest score of naturalness is in the photo number 6 and the highest score of complexity is in the photo number 10. While the lowest scores of beautifulness, uniqueness, naturalness, harmonious, call to mind, resting, perceptible, coherence, sustainable, texture and visual effect are in the photo number 4, the lowest scores of variety, complexity and color are in the photo number 1.

In order to determine the relationships between adjectives and participant values, correlation analysis was carried out. As a result of this analysis, a relationship age groups and adjectives (complexity, uniqueness, naturalness) and design elements (form) are directly. The other relationship between the participant features and the adjectives and design elements were shown in Table 1. Regression analysis confirmed the importance of using naturalness and unity of the selected photos to describe the vertical garden characteristics. This suggested three possible models and showed that the important variables effecting adjectives are naturalness (β =-0.093 $p < 0.001$), naturalness ($\beta = 0.162$ $p < 0.001$) with call to mind ($\beta = -0.146$ $p < 0.001$) and naturalness ($\beta = 0.163$ $p < 0.001$) call to mind ($\beta = -0.161$ $p < 0.001$) with complexity ($\beta = 0.68$ $p < 0.001$). The final regression model could account for the data. From analysis of the correlation and regression results, naturalness, call to mind and complexity were found to be the most important descriptor for vertical garden designs in visual preference evaluations.

Table 1: The relationships according to correlation analysis

		Coherence	Sustainatable	Variety	Complexity	Color	Form	Texture	Visual effect
Age group	P. Correlation	0,03	0,03	0,02	,097**	0,02	,077*	0,04	0,04
	Sig. (2-tailed)	0,32	0,29	0,47	0,00	0,45	0,01	0,21	0,20
Questionaire group	P. Correlation	-,270**	-,319**	,159**	0,02	-,206**	-,237**	-,297**	-,293**
	Sig. (2-tailed)	0,00	0,00	0,00	0,56	0,00	0,00	0,00	0,00
Gender	P. Correlation	-0,06	-0,03	-0,06	-0,06	-0,05	-,090**	-,094**	-0,05
	Sig. (2-tailed)	0,07	0,30	0,05	0,05	0,09	0,00	0,00	0,08
Income	P. Correlation	0,02	0,05	0,04	,114**	,066*	,074*	0,02	,067*
	Sig. (2-tailed)	0,49	0,12	0,19	0,00	0,03	0,02	0,58	0,03
Marital status	P. Correlation	,071*	,080**	0,04	-0,03	0,05	0,01	0,04	0,00
	Sig. (2-tailed)	0,02	0,01	0,20	0,38	0,08	0,85	0,24	0,98

		Beautifulness	Uniqueness	Naturalness	Harmonious	Call to mind	Resting	Perceptible
Age group	P. Correlation	0,00	,064*	,061*	0,03	0,04	0,06	0,06
	Sig. (2-tailed)	0,89	0,04	0,05	0,30	0,21	0,07	0,07
Questionaire group	P. Correlation	-,230**	-,191**	-,145**	-,136**	-,250**	-,171**	-,315**
	Sig. (2-tailed)	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gender	P. Correlation	-,071*	-,138**	-,087**	-0,02	-,062*	-,076*	-,086**
	Sig. (2-tailed)	0,02	0,00	0,00	0,52	0,04	0,01	0,01
Income	P. Correlation	0,00	0,04	0,04	0,00	,091**	0,04	,084**
	Sig. (2-tailed)	1,00	0,16	0,26	0,92	0,00	0,16	0,01
Marital status	P. Correlation	,078*	,066*	0,04	,074*	0,03	0,05	0,01
	Sig. (2-tailed)	0,01	0,03	0,21	0,01	0,32	0,10	0,76

4 Conclusion and Outlook

This study aimed to determine the visual preferences of vertical garden design is the basis for the work to be done in this direction. To summarize the results obtained from the study: Designs visually perceived by participants are more important than designs that designers don't take into account users. Informal lines and warm colors are the most important component in the design of vertical gardens. Naturalness, call to mind and complexity are important elements of visual perception which will be held on vertical gardens in visual studies. Demographic structure in the perception of vertical gardens is an important social phenomenon. Beauty-uniqueness-naturalness-harmonious-call to mind-resting-perceptible-visual effect-coherence-sustainable-variety-complexity-color-form-texture are appropriate to use in visual studies. People prefer designs include warm color and informal lines rather than formal lines and cold color.

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