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THE EFFECT OF SEASONAL CHANGE OF PLANTS COMPOSITIONS ON VISUAL PERCEPTION

Engin Eroğlu[1], Haldun Müderrisoğlu[2], Güniz Akıncı Kesim[2]

[1]*Department of Landscape Architecture, Faculty of Forestry, Karadeniz Technical University, 61080 Trabzon, Turkey*
[2]*Department of Landscape Architecture, Faculty of Forestry, Düzce University, 81000 Düzce, Turkey*
E-mail: [1]eroglu_e@ktu.edu.tr (corresponding author)

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Abstract. Plants are important elements of open-green areas in the urban space and perception of an environment. Some plants have seasonal colour changes. The identification of these changes and clarification of the effects on people are quite important for landscape architecture. Seasonal changes of plants in some open-green areas in Düzce were examined in order to explain how it affects people regarding changes in perceptional preferences. Delphi Method was used on photographs as a mean of identification of the visual effects of the plant compositions. The plant composition photographs, which had been examined before, were used in the questionnaire to 370 student groups.

As a result, the difference was evaluated between the perceiving of different plant compositions. Summer was the most affecting season having the design value and visual quality. Besides, evergreen plants had a positive effect on design power and visual quality of compositions. Furthermore, as another important result, it was found out that socio-economic levels of the people had some important effects on visual preferences.

In this study, perceptional differences of the participants on seasonal changes of the plants were identified. Moreover, the form and the texture were evaluated for identifying perceptional effects.

Keywords: plants, seasonal change, visual perception, semantic differential scale, landscape architecture.

1. Introduction

Mountains are important sources of water, energy and biological diversity. Their altitudinal range leads to variations in temperature, precipitation and radiation that constitute numerous habitats. Mountainous regions cover more than 20% of the world's surface but only 10% of the world's population live in or around them (Karadeniz, Günes 2002; Csereklye 2010). In recent years, mountain ecosystems have been studied in relation to global warming, erosion, and negative changes in water resources (e.g. pollution), as well as for their rich biological diversity. Increasing tourism and recreation in mountain areas have fueled people's wish to know more about mountains (Acar *et al.* 2006).

Approximately two-thirds of Turkey's total land area is classified as mountainous: 56.6% of the land mass is > 1000 m and 29.9% is between 1000–1500 m (Atalay 2002). The mountains of North Anatolia and Taurus, which are part of the Alpine-Himalayan mountain belt, have played important roles in supporting "yayla" (local people visiting and/or living on very high plateaus), in stockbreeding activities and in cultural needs.

Nowadays, protecting and managing landscapes have become an important issue because of previous inappropriate land-use activities, mainly caused by population growth. Evaluation of natural resources can be based on land use, protection or combination of both. Thus, the physical and ecological resources that contribute to visual features are the basis of the scenic landscape and important in evaluation and management. The human observer of the visual landscape is also important when defining landscapes (Appleton 1975; Ulrich 1986; Bell 1993; Daniel, Maitner 2001; Behbahani, Haghighi 2009). Because of trying to supply increasing human needs, natural balance and the relations between humanity and nature have been forced. According to Yılmaz, H. and Yılmaz, S. (1997), owing to changing needs and technological improvements, cities which possess human and natural-cultural environments, have some negative effects on socio-cultural life of people. One of the most important problems in urban areas is lack of open green areas which provide rising to some ecological balance problems, which threats future of cities. Therefore, living in a natural and beautiful environment is desired by human choosing appropriate plant species regarding to aesthetical and functional ways can be done (Kelkit 2002).

During the landscape design and planning, conservation of natural or cultural areas should be the major purpose. Doubtless plants are the most important elements of planting design. (Acar 1997; Acar *et al.* 2002). Plants' contributions to the environment are not only aesthetical such as leafs, fruits and flowers but also ecological and identity transmitting (Eroğlu *et al.* 2006).

Colour, texture, size and form are the main instruments for plant compositions. Among all, because of the visual perception, the most significant one is colour. Being the most changeable elements of nature and giving emo-

tional perceptions, which define physiological situations, are the characteristics of colours. Differences in colours can easily be recognized, from very far distances, thus they sometimes provide different functions in short and long terms (Acar *et al.* 2007). Using colours is the best way to show the differences in plant compositions depending on seasons because people can mostly realize the differences from the colours (Nelson 2004; Robinson 2004).

Plants should be evaluated as plant composition materials in the researches regarding environmental perception, because of design instruments. In this kind of researches participants' answers are defined to be important materials for identifying the effects of compositions (Altman, Wohlwill 1983; Nasar 1988). According to Ulrich *et al.* (1991), density of plants in an area made people relax. Serpa and Muhar (1996) claimed that small trees were perceived closer when comparing with bigger ones. Plant texture was the another important component. Plants having thinner branches and leafs were perceived closer. Summit and Sommer (1999) made it clear that similar plant forms were perceived similarly and forms had important semantic differences. According to Misgav (2000), some forest areas and plant groups were evaluated in the way of visual quality. As the other interesting result, Jorgensen *et al.* (2002) found that older plants were very effective for the users to feel more secure near the borders of forests.

Akbar *et al.* (2003) claimed that plants situated along a road play an important role in beauty concept of the road. Most of the participants defined the plants located along the road as "graceless" and "brown". According to the same study, people often preferred to see cosmopolite plant compositions than monotones. Müderrisoğlu and Eroğlu (2006) detected that plants had different visual perception value covered by snow. For instance, *Cedrus atlantica* (Endl.) Carr. has no visual perception differences depending on the seasons, while *Pinus slyvestris* L. was defined as "more beautiful" under snow body. In addition, Müderrisoğlu *et al.* (2006) found that pyramid forms were defined more beautiful than the rest when being solitary.

Delphi and semantic difference techniques are often used in visual perception studies (Litton 1968; Carry 1974; Kaplan 1979; Daniel, Vinning 1983; Özgen 1984; Ulrich 1986; Amir, Sabol 1990; Tahvanainen *et al.* 2000; Daniel, Meitner 2001; Acar *et al.* 2003; Eroğlu 2004; Müderrisoğlu, Eroğlu 2006; Müderrisoğlu *et al.* 2006). In this study, seasonal changes in plant compositions were thought to have an important effect on the perceiving of them. Therefore, our aims were:

- To identify effects of seasonal changes on visual perception,
- To determine what kind of compositions in which season affect perception of people,
- To identify which group of plants is effective as seasonal changing in planting design.

As a result, the relations between plants and plant groups and users' request and the differences owing to different socio-economical groups and perception styles were defined.

2. Material and methods

2.1. Study area

The research was carried out in the open and green areas of Düzce. This area was selected because it had never been used for this purpose. Such limited arranged area in the city was the most important element affecting the selection of sample area negatively. Because of having the densest use in the city and being arranged in terms of the landscape architecture or showing these characteristics were taken into consideration, the area was significant for the study.

Düzce province, the research field is located between the 400 40′–400 47′ north altitudes and 310 21′–310 26′ east longitudes and, situated in the North West part of Black Sea region, in Turkey. It shows the climate of western part of Black Sea 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. Düzce takes place (from the three flora regions) in the Euro-Siberian Euxine subregion and A3 square. This region is not rich for endemism; however, there are some endemic species in the high mountainous parts. In addition, the region has a rich structure with respect to natural species found in it. (Yaltırık, Efe 1989; Kesim 1996; Mansuroğlu 1997; Özyuvacı 1999; Anonymous 2001) (Fig. 1).

Fig. 1. The location of the study and taken photographs areas

2.2. Material

The plants in the open and green areas of the city Düzce were the main material of this study. The photos of several plants and plant groups were used as the questionnaire material. Photos to determine four seasons differences of the compositions during a year were taken from roads and refuges from, İnönü Park, Anıt Park-City Park and Celalettin Özdal Park. Especially, woody plants were chosen for taking photos due to the human eye perception level and above. In plants as a basis, 1 m and 20–30 m lengths were selected for low and high limit, respectively. The compositions including these plants were preferred also in the vegetative design evaluations.

2.3. Methods

2.3.1. Determination and photographing of the plant groups

Studies carried out concerning the visual evaluations, were done only by the experts brought up misleading results. Because of the fact that the preferences made by the experts according to the criteria, they did not show parallelism with the users' (Litton 1968; Daniel, Vinning 1983; Ulrich 1986). For this reason, both groups in the study were taken into evaluation.

Carry (1974), Kaplan (1985), and Amir and Sabol (1990) evaluated showing the reactions of the public to the photograph groups as an effective method in the description of the landscape elements. Photographs of 18 different plant groups were taken from roads and refuges of İnönü Park, Anıt Park-City Park and Celalettin Özdal Park.

The selected compositions consist of a single plant or its composition having a solitaire characteristic, or of compositions that have evergreen or deciduous plants and that are evenly distributed.

Taking photographs was carried out in the middle of the four seasons and hours having the same amount of light. The difference only in the angular decrease according to the seasons could be seen by the amount of light. Moreover, photographs were taken from the same point and in the same objective adjustment for each season. In the photographing an automatic camera was used, which could be zoomed 140 mm.

In order to determine the ratios of plant distribution on the visions of the photograph groups, area calculation was carried out. During area calculation, Auto-CAD architectural design program was used. Plants were evaluated into the two groups such as the areas consisting of deciduous and evergreen plants on the photographs.

2.3.2. Evaluation of photograph by experts

Due to the fact that the safety of the evaluation was significant, it could be done by experts, specialized in this subject (Hess, King 2002). This method was used to determine the developed habitat by Crance (1987). Several alternatives were improved and these were evaluated by the specialists in two steps. In the study done with parallel to this method called Delphi Method, specialists were used in order to determine the photograph groups.

The photographs were sent to the academicians, specialized in this subject in the Turkish Universities together with the evaluation questionnaire by e-mail. Evaluation questionnaire was prepared as a Word document. In the questionnaire, they were asked to evaluate the photograph groups as follows: inappropriate – appropriate – most appropriate for the subject.

In the first stage, 14 out of the 28 specialists responded to the questionnaires. In the second stage, photographs were sent to the specialist group of 11 people for the eliminations and only four of the specialists responded. The photograph groups that were evaluated as appropriate and most appropriate were chosen according to the responses. After this determination, the number of the photograph groups, which was 18, was decreased to 10.

2.3.3. Carrying out the questionnaires and their evaluation

The questionnaires were administered to the students of Abant İzzet Baysal University, Düzce Campus. These student groups consisted of three different student groups from the Faculty of Forestry, Faculty of Education and Faculty of Medicine. Totally, 370 questionnaires were carried out in November 2003 and February 2004. Dwyer (1994) stated that as the ages of users increased their participation in recreational activities decreases and that the highest recreational participants were young people between the ages of 18–24. This age group defined the users in the university in Turkey. Therefore, in this study, recreational experiences and demographic characteristics of university students had been examined.

The method developed by Osgood *et al.* (1957) is known as "Semantic Differential Scale Technique" or "Semantic Differential Technique". According to it, the opposite adjective pairs are determined and these adjective pairs are offered to the subjects with a scale, and then the subjects mark the choices that are suitable for them from the 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. According to Penning-Rowsell (1979), in the landscape quality and visual evaluation, the responses of the evaluators were true and good (Misgav 2000).

In the questionnaire, the determined adjective groups were given to the subjects for evaluation and selected in a way to show the differences between the visual quality and the design perception in the plant groups. Visual quality implicates the emotions, but visual strength was determined by the physical characteristics. They were determined as "disliked-liked", "ugly-beautiful", "disturbing-comforting", "unimpressive-impressive", "unsafety-safety", "artificial-natural", "Unattractive-attractive", "untidy-tidy" and "plain-ornamented". Summit and Sommer (1999) divided the adjective pairs into two groups in determining the perception of the plant forms. In addition, Acar *et al.* (2003) aimed to compare the adjective pairs as negative and positive within themselves while classifying the adjective pairs. In this study, handling the adjective pairs comparatively was the main purpose.

The determined adjective pairs were written down in the questionnaire. In the questionnaire, each determined adjective pairs was evaluated as 5-point such as –2, –1, 0, 1, 2. Besides, in order to determine whether there was a difference in the questionnaire according to the socio-economic structures of the subjects or not, the subjects were asked about their residences, incomes, gender and the school they attended.

The data were analysed using the SPSS (Statistical Package for Social Science) 15.0 statistical package (Acar *et al.* 2003, 2007; Eroğlu 2004; Eroğlu *et al.* 2006; Alkan *et al*. 2009).

In order to input the data to the computer, the values of 1, 2, 3, 4, 5 were used instead of –2,–1, 0, 1, 2. Besides, for the markings not to be taken into consideration, 0 was used.

Factor analysis was used in the explanation of adjective pairs; correlation analysis was used in the evaluation of the adjectives seasonally and in the determination of the socio-economic differentiation. Finally, in order to find out the criteria determining changes in the perception of adjective groups and their degrees of effect, regression analysis was used with the Stepwise method.

3. Results

In Table 1, the evaluation codes of the gathered data are shown. According to table, 61% of the participants were male, 39% – female, 34% of students were from Natural and Applied Sciences, 36% Medical Sciences and 30% Social Sciences. In addition, 57% of the participants lived in the city center, 29% in the towns, 5% in the neighbourhoods and 9% in the villages. Their income levels: 59% were between $0–750, 33% were $751–1500 and 8% were over $1500.

Table 1. Characteristics of the participants and their evaluation codes

	Characteristics of the participants	Code	%
Gender	Male	1	61
	Female	2	39
Education	Natural and Applied Sciences	1	34
	Medical Sciences	2	36
	Social Sciences	3	30
Living Area	City	1	57
	Town	2	29
	Village	3	5
	Rural area	4	9
Income $	0–500	1	59
	501–1000	2	33
	1000+	3	8
Seasons	Autumn	1	25
	Winter	2	25
	Spring	3	25
	Summer	4	25
Decidous Plant Area	0–17%	1	25
	17.1–34%	2	40
	34.1–51%	3	25
	51.1–68%	4	10
Everygreen Plant Area	0–5%	1	27.5
	5.1–10%	2	22.5
	10.1–15%	3	12.5
	15.1–20%	4	37.5

3.1. Explanation of adjective pairs

Factor analysis was used in the explanation of the effective adjective pairs. In this study 9 adjective groups were taken into evaluation. As seen in Table 2, two factors were found, explained by 63.6% variance. I. factor was explained with the variance of 49.1%. I. factor included 7 adjective groups. In that 7 adjective groups of the adjective pairs were determined to show the visual quality of the compositions by two factors: disliked-liked, ugly-beautiful, disturbing-comforting, unimpressive-impressive, unsafety-safety, unattractive-attractive and plain-ornamented. II. factor was explained with the variance of 14.5%. II. factor included 4 adjective pairs to show the design strength of the compositions: unattractive-attractive, plain-ornamented, artificial-natural and untidy-tidy. The adjective pairs: unattractive-attractive and plain-ornamented were effective in the evaluation of both groups.

Table 2. Effective adjective pairs affecting the compositions (Factor Analysis)

Adjectives	**Factor I (Quality)**	**Factor II (Strength)**
Disliked-liked	0.87	
Ugly-beautiful	0.85	
Disturbing-comforting	0.85	
Unimpressive-impressive	0.85	
Unsafety-safety	0.79	
Unattractive-attractive	0.67	0.34
Plain-ornamented	0.56	0.50
Artificial-natural		0.70
Untidy-tidy		0.57
Variance (%)	49.1	14.5
Mean	3.34	2.80
Cronbach's Alpha	0.88	0.42

3.2. The relationships between the photograph groups and the adjective pairs

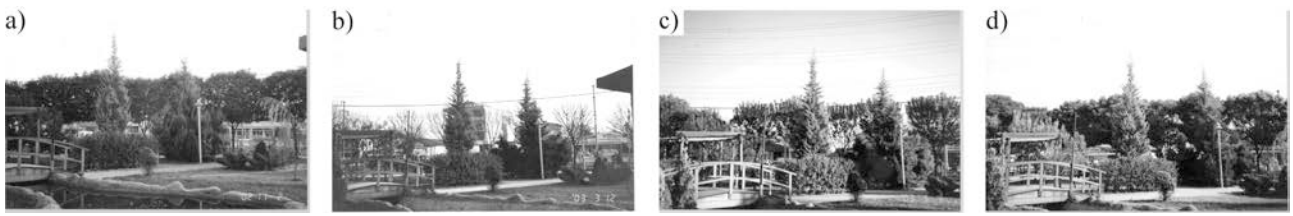
During determining the relationship between the photograph groups and the adjective groups, arithmetical means of the values and standard deviations were found. According to these results, the photograph groups 5 and 7 provided the highest visual quality and the strength values. The value of the lowest visual quality and the strength were in the photograph groups 1 and 9. Generally, participants found the photograph groups positive in terms of both design strength and visual quality. These relationships between the adjective groups and the photograph groups are given in Table 3 (Fig. 2, 3).

Table 3. Adjective groups defining the photograph groups (Arithmetic Means)

Photograph Groups		Adjective Groups										
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**Quality**	**Strength**
1	M	3,4	3,5	3,5	2,9	3,3	3,0	2,6	2,7	2,5	**3,0**	**2,6**
	S. D	1,2	1,1	1,1	1,3	1,1	1,4	1,3	1,3	1,3	0,9	0,7
2	M	3,3	3,4	3,3	3,1	3,2	2,4	2,9	3,0	2,7	3,1	2,7
	S. D	1,4	1,3	1,3	1,3	1,3	1,4	1,3	1,4	1,3	1,0	0,7
3	M	3,7	3,7	3,7	3,4	3,5	2,6	2,9	2,7	2,7	3,4	2,7
	S. D	1,1	1,1	1,5	1,2	1,2	1,3	1,3	1,3	1,4	0,9	0,8
4	M	3,5	3,6	3,4	3,2	3,3	2,4	3,1	2,9	2,8	3,3	2,8
	S. D	1,2	1,2	1,3	1,3	1,2	1,2	1,3	1,3	1,3	0,9	0,7
5	M	4,1	4,0	4,0	3,8	3,7	3,1	3,3	2,3	3,3	**3,8**	**3,0**
	S. D	1,0	1,0	1,1	1,1	1,1	1,5	1,3	1,3	1,4	0,9	0,8
6	M	3,3	3,3	3,2	3,0	3,1	2,4	3,0	3,1	2,7	3,1	2,8
	S. D	1,3	1,2	1,3	1,3	1,2	1,3	1,4	1,3	1,3	1,0	0,7
7	M	4,0	4,0	3,9	3,8	3,7	2,6	3,5	2,6	3,3	**3,7**	**3,0**
	S. D	1,0	1,0	1,0	1,1	1,0	1,3	1,2	1,2	1,3	0,8	0,7
8	M	3,8	3,8	3,7	3,6	3,4	2,2	2,9	2,5	2,9	3,4	2,7
	S. D	1,2	1,2	1,2	1,3	1,2	1,3	1,4	1,3	1,4	1,0	0,8
9	M	3,4	3,4	3,2	3,0	3,2	3,2	2,8	2,1	2,6	**3,0**	**2,6**
	S. D	1,3	1,3	1,3	1,4	1,3	1,4	1,4	1,3	1,4	1,0	0,8
10	M	3,7	3,7	3,6	3,4	3,4	2,8	3,2	2,7	3,1	3,4	3,0
	S. D	1,1	1,1	1,1	1,3	1,2	1,3	1,3	1,3	1,3	1,0	0,8
Total	M	3,6	3,6	3,5	3,3	3,4	2,7	3,0	2,7	2,9	3,3	2,8
	S. D	1,2	1,2	1,2	1,3	1,2	1,4	1,3	1,3	1,4	1,0	0,8

a. Disliked-liked; b. Ugly-beautiful; c. Disturbing-comforting; d. Unimpressive-impressive; e. Unsafety-safety; f. Artificial-natural; g. Unattractive-attractive; h. Untidy-tidy; i. Plain-ornamented; M: Mean, S. D: Standard Deviation

5. Photograph Group (a: Autumn, b: Winter, c: Spring, d: Summer)



7. Photograph Group (a: Autumn, b: Winter, c: Spring, d: Summer)

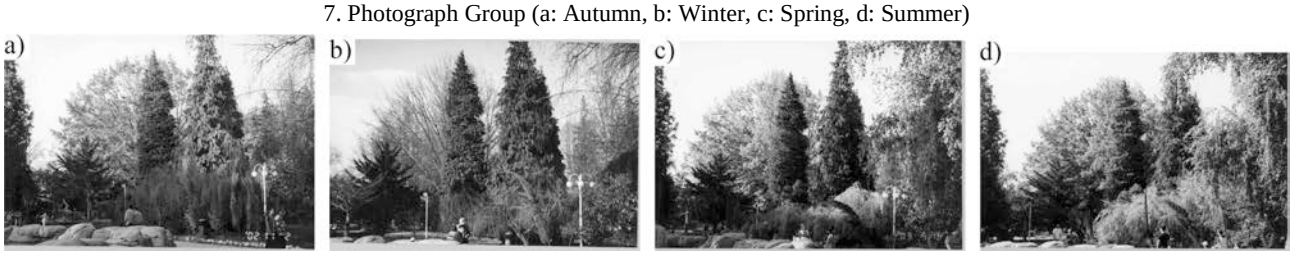


Fig. 2. Photograph groups with high visual quality and strength values

1. Photograph Group (a: Autumn, b: Winter, c: Spring, d: Summer)

9. Photograph Group (a: Autumn, b: Winter, c: Spring, d: Summer)

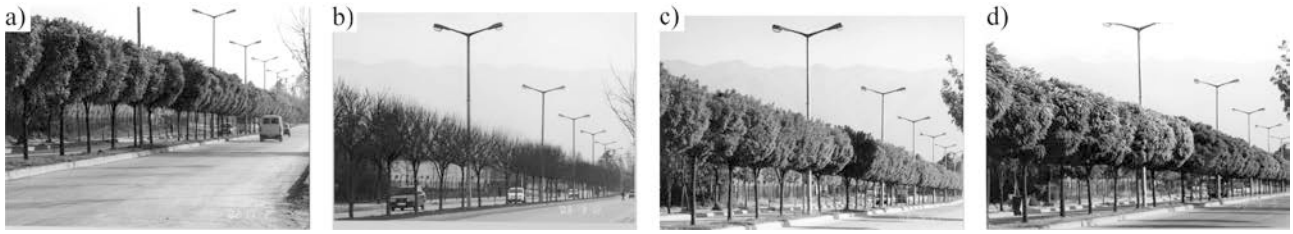


Fig. 3. Photograph groups with low visual quality and strength values

3.3. The relationships between the seasons and the adjective pairs

In order to determine the relationships between the seasons and the adjectives, correlation analysis was carried out. As a result, the relationship directly proportional to quality and strength, and adjectives from the fall to summer was found. Summer was the one having the highest quality and strength adjectives while the winter had the lowest. This relationship between the seasons and the adjectives are presented in Table 4.

3.4. The relationships between the areas that the plants cover on the photographs and the adjective pairs

Correlation analysis was carried out during determining the relationships between the areas that the plants covered on the photographs and the adjective groups therefore true perceptional relationship was found between the evergreen plants and deciduous plant ratio and quality and strength groups in the compositions. The relationship in the ratio of the evergreen and the deciduous in the compositions could be explained as follows. According to this, as the ratio of the deciduous in the composition increases, the visual quality of the compositions also increased and as the ratio of evergreen in the composition increase, the compositions were perceived stronger in terms of designation. The relation between the evergreen and deciduous plant ratio and just the adjective pair regular-irregular were opposite. As the ratio of the plant groups in the compositions increase, the groups were perceived more irregular (Table 5).

3.5. The effect of photograph groups and characteristics of the participants on the perception of the adjective groups

The regression analysis was carried out with Stepwise Method for determining the effect of photograph groups and the characteristics of participants on the adjective groups. The relationships defining the adjective groups were shown with these analyses. These groups defining the perception of photograph groups included the seasons determining the visual quality, the ratio of evergreen and deciduous plants on the photograph, residence, income, and gender were effective. From these results, the season was the most effective determinant. It was followed by gender and the ratios of evergreen and deciduous plants. In the determination of the design strength of the groups, seasons, the amount of evergreen and deciduous plant on the photograph, education, residence and gender were the determinants. Eventually, gender was the most effective determinant determining design strength. After gender, the most effective determinant was seasons (Table 6).

Table 4. The relationships between the seasons and the adjective pairs according to correlation analysis

	Adjective Groups									Quality	Strength
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**		
Seasons	$0{,}17^{***}$	$0{,}17^{***}$	$0{,}17^{***}$	$0{,}16^{***}$	$0{,}16^{***}$	$-0{,}34^{***}$	$0{,}16^{***}$	$-0{,}56^{***}$	$0{,}15^{***}$	$0{,}21^{***}$	$0{,}10^{***}$

*p < 0.05, **p < 0.01, ***p < 0.001; a. Disliked-liked; b. Ugly-beautiful; c. Disturbing-comforting; d. Unimpressive-impressive; e. Unsafety-safety; f. Artificial-natural; g. Unattractive-attractive; h. Untidy-tidy; i. Plain-ornamented

Table 5. The relationships between the adjective pairs and the plant areas on the photographs according to correlation analysis

	Adjective Groups									Quality	Strength
	a	b	c	d	e	f	g	h	i		
Everygreen Plants	0,07***	0,06***	0,04***	0,09***	0,02	–0,09***	0,06***	0,05***	0,06***	0,08***	0,04***
Decidous Plants	0,11***	0,12***	0,12***	0,10***	0,11***	–0,15***	0,11***	0,03***	0,07***	0,13***	0,02

*p < 0.05, **p < 0.01, ***p < 0.001; a. Disliked-liked; b. Ugly-beautiful; c. Disturbing-comforting; d. Unimpressive-impressive; e. Unsafety-safety; f. Artificial-natural; g. Unattractive-attractive; h. Untidy-tidy; i. Plain-ornamented

Table 6. The effect of photograph groups and characteristics of participants on the adjective groups according to regression analysis

Characteristics of the participants	Adjective Groups									Quality	Strength
	a	b	c	d	e	f	g	h	i		
Coefficient	3***	3***	3***	2.5***	3***	4***	2.5***	2.3***	2.5***	3***	3***
Seasons	1.6***	0.15***	1.6***	0.17***	0.15***	0.03**	0.16***	–0.09***	0.19***	0.16***	0.07***
E. P.	0.07***	0.07***	0.05***	0.10***	0.02***	–0.11***	0.07***	0.05***	0.07***	0.07***	0.03***
D. P.	0.07***	0.09***	0.09***	0.06***	0.07***	–0.02***	0.08***	0.08***		0.07***	
Living Area	0.05***	0.06***	0.02*	0.03**			0.05***	0.04***		0.03**	0.02*
Income	–0.08***	–0.09***	–0.04*			0.04*		0.05**		–0.03*	0.03**
Gender				–0.08***		–0.03***	–0.20***	–0.06*	–0.27***	–0.09***	–0.21***
Education	–0.05***	–0.06***		0.03*		0.06***	–0.06***	0.08***	0.05**		0.03**
R^2	0.04	0.05	0.04	0.04	0.03	0.04	0.04	0.01	0.04	0.06	0.03
F	100.4*	114.3***	107.9***	93.5***	114.7***	108.5***	100.5***	25.6***	141.2***	145.3***	71.4***

*p < 0.05, **p < 0.01, ***p < 0.001; a. Disliked-liked; b. Ugly-beautiful; c. Disturbing-comforting; d. Unimpressive-impressive; e. Unsafety-safety; f. Artificial-natural; g. Unattractive-attractive; h. Untidy-tidy; i. Plain-ornamented; E. P: evergreen plants; D. P: deciduous plants.

4. Discussion

In this study, it was tried to find out solutions for some specific questions and these solutions were stated. Effects on the perception of plant compositions within the city landscape were stated.

According to Zolingen and Klaassen (2003), it was important for the suitability to the objective to benefit from the specialists in the definition of the issue. The evaluations sent to the specialists were carried out in two turns and that affected the result of the technique positively. By using "Delphi Technique" or "Specialists' Technique" as the method, the main goal of the first study was to eliminate the 18 photograph groups and determine the photographs that were suitable for the objective. In the first turn, the photographs were sent to 28 specialists and 14 of them sent back their responses, and in the second turn, from the first pre-elimination results sent to 14 specialists only 4 specialists sent back their responses. In the light of the responses obtained, the number of the photograph groups was decreased to 10 and they were evaluated in the questionnaire.

Summit and Sommer (1999) gathered the adjective pairs in two main groups during the determination of visual perception of the tree forms. The first group indicated the visual quality of the forms while the second group indicated their design strength. The adjective pairs of strongly, permanent, sound and ornamented determined the design strength, as the visual quality was determined by the adjectives comforting, beautiful, safety, tough, and sincere. As a result of the analysis done in this study, the adjective pairs were gathered in two main groups and these were called as quality and strength adjectives. Visual quality was stated by admiration, liked, safety, impressive, comforting and beauty while design strength was stated by order, plain, tidy, attractive and natural.

Misgav (2000) stated that long trees had higher visual preferences than short trees and bushes. The plant groups consisting the photograph groups evaluated within the research include long trees and being the visual quality values of photograph groups high were in a supportive way. In addition, the plants that have high visual quality were evergreen plants and their several compositions. According to the earlier studies, increasing in the density of evergreen plant compositions in the photograph groups also caused increasing the visual quality of the photographs groups. However, in this study, the effects of evergreen plants on visual quality were lower than the deciduous plants (Table 5).

Jorgensen *et al.* (2002) detected that flowering and growing leaves in the plants changed directly proportional to the perception of safety. It was also mentioned in the same study that winter photographs were evaluated as the least reliable group. A range of safety perception was determined in the form of Summer-Spring-Fall-Winter.

Plant groups had important role in the perception of roadside beauty (Akbar *et al.* 2003). Although being a single kind in the research area made the area seen positively in terms of beauty and liked, it was stated that people

adopted mixed vegetations more than that type of vegetation. In the case of handling the photograph group 9 as roadside vegetation within the research, it was seen that a single type (*Robinia pseudoacacia* DC. cv. 'Umbraculifera') was formed. Although both design strength and visual quality of this photograph group were high, visual quality values in the other photograph groups were low. This may be interpreted such that the group included single type and that the other groups were taken reciprocally.

While the highest visual quality and design strength values were seen in the photograph groups 5 and 7, the lowest values were seen in the photograph groups 1 and 9. As a significant effect of that result, the group 5 and 7 had richness on the plant types on the photos, altitude in the ratio of evergreen plants and especially more colour changes according to the seasons. Seasons and the richness of the species in the mixed compositions showed especially different colourings in the same compositions, and affected the visual perception positively. It showed that particularly the fourth season values of the group 7 were high.

In general, in the summer when deciduous plant compositions relatively increase and reach the highest level, the visual quality and design strength of the compositions increase. However, in this study, it was found out that photograph groups 5 and 7, especially group 7, had the most balanced mixture ratios and the highest design strength and visual quality value and it showed that neither evergreen plants nor deciduous plants alone were taken place. For this reason, in order to provide the seasonal distribution of the compositions and make the values of visual perception high, there should be a good balance between both the evergreen plants and the deciduous plants.

There was a close relationship between the visual quality and design powers of photograph groups and seasons, particularly it was seen in the range of Summer-Spring-Fall-Winter from a preference from more to less. The increase in green colouring on the leaves affected the visual quality positively. Moreover, summer was perceived natural and tidy in contrast to winter. The green colour was a symbol of naturalness and form changes of the plants with growing leaves, hence the road to naturalness, showed the regularity in the designs.

Serpa and Muhar (1996) stated that gender played an important role on the perception of the plants that people lived around. Strumse (1996) indicated that gender, age, the surroundings people lived and their experiences were effective on visual perception and besides in this study, demographical structure was the determining element in the perception of seasonal change of the plants. Women participants especially found summer photographs and compositions more artificial, opposite to men participants. This effect was the same like increasing in the income level. In the residence from rural areas to downtowns, this relationship was similar.

5. Conclusion

In conclusion, the effects of seasonal changes of the plant compositions on human beings were determined with this research. However, it is known that not only the seasons but also several other effects are important in the perception of the compositions. In order to get more productive results for this study, participation of the specialists should be higher. In addition, in the demographical structure in this research, only students were aimed. Apart from the students, an experiment of the same kind to public and specialist can be done. The following results were obtained from this research.

1. Proportional increase in evergreen and deciduous plants affected the compositions visually positive. However, the increase in deciduous plants was more effective in visual quality whereas the increase in evergreen plants affected the design strength of compositions more.

2. The plant compositions were preferred more in summer than winter as visual.

3. Flowering and leafing in the plants affected the safety perception of the compositions.

4. In the evaluation of the visual perception, the responses by the participants were very important and their demographical structures were effective in this perception. Especially, gender and residence also played an effective role.

5. The observations in this study pointed to the importance of future studies to examine all the features such as foliage, flowers and fruits altogether, as well as form colour, texture and size.

6. Some evergreen and deciduous plants such as *Robinia pseudoacacia* DC. cv. 'Umbraculifera' and *Cedrus atlantica* (Endl.) Carr. effected on visual perception of seasonal change of plant composition. So that, like these plants may be used in landscape for designing and planting design.

7. All of the results showed that seasonal effects of plant compositions in planting design is a visual event and was effected perception of people. So, landscape designers and operators should be evaluated that in their landscape projects and applications.

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SEZONINIO AUGALIJOS SUDĖTIES POKYČIO ĮTAKA VIZUALIAM SUVOKIMUI

E. Eroğlu, H. Müderrisoğlu, G. A. Kesim

Santrauka

Reikšmingas urbanizuotos teritorijos elementas yra želdynų augalija. Kai kurios augalų rūšys kintant sezonui keičia spalvas. Suvokiant šių pokyčių poveikį žmogui, svarbu tai pritaikyti kuriant kraštovaizdžio architektūrą. Sezoninių augalijos pokyčių poveikiui tirti pasirinkta ãtviros Düzce apylinkių vietos. Vizualiam augalijos poveikiui nustatyti taikytas *Delphi* fotonuotraukų metodas. Anksčiau vertintos nuotraukos buvo panaudotos apklausoje, kurioje dalyvavo 370 studentų grupių. Vertinti augalijos skirtingos sudėties suvokimo skirtumai. Nustatyta, kad didžiausią poveikį vizuali želdinių projektavimo kokybė daro vasaros sezoną. Respondentai, vertindami projektavimą ir vizualią augalijos sudėties kokybę, teigiamai pažymėjo višzalius augalus. Iš apklausų nustatyta, kad didelę įtaką vizualiam suvokimui turi socialiniai-ekonominiai žmonių skirtumai. Įvertinta ir projektuojamų želdinių formos bei sandaros reikšmė suvokiant vaizdo efektus.

Reikšminiai žodžiai: augalai, sezoninis pokytis, vizualus suvokimas, semantinė diferencinė skalė, kraštovaizdžio architektūra.

Engin EROĞLU. Research Assistant (since 2000), Department of Landscape Architecture, Faculty of Forestry, Karadeniz Technical University, Trabzon, Turkey. Research interests: planting design, ground cover plants, native plants, alpine and subalpine plants, rural landscape.

Haldun MÜDERRISOĞLU. Assoc. Prof. Dr (since 2008), Department of Landscape Architecture, Faculty of Forestry, Düzce University, Trabzon, Turkey. Research interests: recreational planning, carrying capacity, rural landscape, conservation areas, visual assessment.

Güniz AKINCI KESIM. Prof. Dr (since 1998), Department of Landscape Architecture, Faculty of Forestry, Düzce University, Trabzon, Turkey. Research interests: landscape architecture, open and green areas, environmental issues.