

Full Length Research Paper

The relationship between landscape planting patterns and perceived safety in urban parks in Tabriz, Iran

Hami, Ahmad¹, Suhardi, Bin Maulan¹, Manohar, Mariapan² and Malekizadeh, Muhammad³

¹Department of Landscape Architecture, Faculty of Design and Architecture, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.

²Departement of Recreation and Ecotourism, Faculty of Forestry, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.

³Department of Architecture, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia (UKM), 43600 UKM Bangi, Selangor, Malaysia.

Accepted 15 May, 2013

The relationship between plants and perceived safety in residential areas has been argued by landscape researchers, but there is inadequate or no relevant literature available on the effect of plants in urban parks' safety. Therefore, a photo-questionnaire survey was conducted among urban park users in Tabriz, Iran to gauge the perceived safety of landscape scene with diverse types of texture to discover its effectiveness, especially in relation to the content of the scene. The survey was composed of 296 participants in November, 2012. The result suggested that landscape scene with vast aspect and physical access was perceived safer than the scene with crowded plants and blocked view. The findings demonstrated that a scene without lawn and water is perceived to be less safe than a scene with lawn and features of water. Moreover, landscape scene with more plant species was unsafe as compared to a scene with fewer plant species. This study proved that a landscape designed with ground cover such as lawn, grass and water feature implies increment of perceived safety in urban parks. Likewise, landscape designers should avoid crowded planting in areas, which obstructs visibility in urban parks and reduces perceived safety. The results expand the application of routine activity (RA) theory in park landscape design in Tabriz, Iran.

Key words: Urban parks, landscape content and perceived safety.

INTRODUCTION

Urban park is one of the most important and public open space in big cities. It is a multifunctional area that can be used for wide range of activities. It can at times be a place for anti-social activities such as drug use and criminal activities. This makes people to feel unsafe in the environment and can quickly decrease the usability of urban parks. Anti-social activities not only correlate with social, cultural and personal traits but also the physical environments and the condition of the place. Anti-social behaviors are given more attention and consideration by

humans and they can be the cause of death, injury, fear, damage, inconvenience, and huge financial expanses as mentioned by Brantinghams (1984). Fear is the result of illegal and anti-social activities. In brief, it was explained that anti-social behaviors as event are the result of the coincidence of four things: a law, an offender, a target and a place (Brantingham and Patricia, 1984). Place is referred to as the physical environment where illegal activity happens. It is argued that the quality of a place can prevent or enhance anti-social activities thus reduces

fear of crime. Therefore, it is important to understand how people perceive safety in urban parks especially in relation to design, specific and roles of plant management. The questions such as which type of planting pattern correlates positively with perceived safety in urban park is posed and develops a basis for this study. This study tends to identify people's preferences of landscape patterns in relation to perceived safety and introduces the most agreed reasons for unsafe feeling in urban parks.

Plants are important elements for green spaces; they not only make spaces attractive but also use in engineering, for climate control and aesthetic purpose (Robinette, 1972). In addition, plant has a wide range of uses and not only for decorative intention (Sommer, 2003). Understanding the relation between fear of crime and setting condition has been studied earlier and the recent conclusion shows that the spatial configuration of a place has an effect on fear of crime more than the crime itself. Therefore, it is necessary to understand that plants' configuration contributes to perceived safety. Cohen and Felson (1979) argued that the role of plants in safety can be explained by Routine Activity (RA) theory. The RA theory explains there are three conditions to be met before a crime can occur. The conditions are potential of crime, potential of victim, and lack of effective authority and control power to observe and respond to a crime.

It is rational that before deciding to act, a criminal would consider the costs and benefits expected of the action. It is argued that in the context of RA theory, plants could influence crime activity in relation to the condition of 'potential of crime'. For instance, if the plants obstruct view, there is a high chance of criminal activity to occur. The plants could reduce the probability of the crime to be observed, which would eventually reduce the expected cost of doing a criminal activity. A study emphasizes that trees and high bushes have negative effect on safety feeling (Fisher and Nasar, 1995). The other study shows the moderation roles of plants in the reduction of aggression and violent behavior (Jieun, 2005), which helps to augment self-control and reduce criminal activity.

Safety of the urban environment and its relation to plant has been an interesting subject for researchers during the last decades. Even though, plant positively contributes to overall safety feeling, a study in urban residential areas showed a negative relationship between plants and safety feeling (Kuo and Sullivan, 2001). A common assumption is that plant can facilitate crime because it helps to hide the perpetrators and their criminal activities and it is particularly implied in the areas with dense vegetation. In one study, participants ranked safety for 180 scenes in urban forests and they feel danger in a densely forested area but feel safe in open areas (Schroeder and Anderson, 1984). A different study showed participants' responses to open-ended questions in which photographs of urban parks revealed that dense vegetated settings were perceived as dangerous areas (Talbot and

Kaplan, 1984) and they asserted that participants not only feared the heavily vegetated areas but some of them had fear of crime in their mind by anticipating that the area is fit for muggers to hide. Michael and Hull (1994) explained that criminals use regularly dense vegetated areas to hide their activities and fear of crime is more tangible when the vegetated close views of scenes and visibility of areas are limited (Michael and Hull, 1994).

On the other hand, some studies show that vegetation reduces fear of illegal and undesirable activities. According to Macdonald and Gifford (1989), well-used residential areas and outdoor spaces with trees are avoided by criminals than treeless spaces because vegetation not only preserves the visibility of space but also increases spatial surveillance (Kuo and Sullivan, 2001). Nasar (1982) explained that landscape features such as plants with high heights are associated with less fear of crime and the result supports a study by Brower et al. (1983). They said that properties with trees and shrubs appear safer than they do not. A study by Kuo and Sullivan (2001) reports that based on police crime reports, the relationship between vegetation and crime in the inner-city is negative. Their study described that significant negative correlation exists between existence of vegetation with total crimes, properties and violent crimes in the inner-city neighborhood areas. They explain that vegetation enhances illegal activities via providing settings for hiding and to prevent the phenomenon proper visibility should be enhanced in the vegetated areas. In addition, people cited landscape with blocked view makes them feel unsafe in the inner-city landscape (Kuo *et al.*, 1998). The literature above shows that the level of vegetation is important for perceived safety and level of vegetation refers to high density. Thus, low and dense vegetated areas will give less safety feeling. It seems that the arrangement of vegetations and visibility of the areas might affect vegetation roles in increasing or decreasing safety feeling in the setting.

Previous researches show that there is relationship between vegetation and criminals as anti-social behaviors. Some of them show positive correlation whilst the others show negative correlation. However, the question remains about the relationship between perceived safety and landscape content such as trees, shrubs, grass, water, and a combination of them. As Kuo et al (1998) have argued that there might be enough information about relationships among grass, trees and safety, but it is unclear if shrubs should be added. Furthermore, parks are places where plants have important role in forming their shape; therefore plants' role in park safety is very important for investigation than inner city areas.

To understand the effect of vegetations on cost of criminal activity, there is an empty room to work on the different vegetation patterns. The quality content of various vegetations can reduce or increase possibility of observing a crime. The combined forms of vegetation and their placement are other important options that should

Table 1. Identified planting patterns in urban park in Tabriz.

Number	Planting patterns in urban parks in Tabriz
1	Trees and shrubs without grass
2	Trees and Shrubs with grass
3	Water, trees and shrubs

be taken into consideration. As the previous study suggested not only vegetation type, size, and location are important but the changes of visual limitation based on the plants' body and properties. The review of vegetation patterns in urban parks of Tabriz shows that the vegetations can be classified into 3 categories: 'Trees, Shrubs with Grass', 'Trees, Shrubs without Grass', and 'Water, Trees, and Shrubs'. Thus, this research tends to answer these following questions: what is the most preferred planting pattern for urban parks in Tabriz? In general, what is the most preferred planting pattern in Tabriz urban parks? How is the relationship between landscape patterns and perceived safety in urban parks in Tabriz? The procedure and methodology used in this study are explained below.

METHODOLOGY

Tabriz location and green spaces

Tabriz is located at '38° 8' and 46° 15' East of Greenwich with an area of about 131 square kilometers (Ghorbani, 2006). Therefore, the city is located in 1200 m above sea level (Rahimi, 2006). In the winter, the average temperature is 12.4°C (88.4°F) and in the summer the average temperature can be up to 34.1°C (110.1°F). Lack of water resources is the most important climatic problem in the city; meanwhile the annual rainfall (snow and rain) is only about 321 and most of the rains occur during winter and spring. Despite harsh weather, the population of this city is 1,579,312, according to the Census Central Organization of Iran (2006).

In total, green space area in Tabriz is about 4.7 m² per capita (in 2006) and this amount is less than the proposed per capita (7-12 m²) by the Ministry of Housing and Urban Development (Ghorbani, 2006). However, in 2011, the green spaces per capita in Tabriz have reached 12 m²/capita which is exactly the ministry's requirement. However, the number is less than that required by the Environment Department of United Nations Organization, which is 20-25 meter square/per capita. Therefore, based on "Tabriz view in 2016", the green space per capita should be increased to 25 m²/per capita. Even though the commitment is applicable, Tabriz like other city in Iran is faced with lack of rain and snow so development of green areas will be highly cost. Therefore, landscape development should fulfill residents' needs and preferences to minimize operational cost. However, despite good number of green spaces in Tabriz, safety is an issue and to tackle this problem, the park design should constantly change. So, there is a need to know the designs that can reduce fear and increase safety. It is proposed that the relation between planting patterns and perceived safety should be investigated.

A survey method was used to gather data in this study because it allows large number of population to participate and also accurate answer can be achieved via photo-questionnaire as survey instrument. Photo questionnaire has been acknowledged as a valid and reliable method to represent real and actual environment (Gau

and Pratt, 2008). The questionnaire for this study included set of questions regarding the degree of safety feeling in each landscape scene as dependent variable (10 landscape scenes), plants' role in perceived safety measured by a Likert scale (1 = strongly disagree to 5 = strongly agree), and demographic questions (measured by categorical technique) as independent variables. In other words, how do the landscape patterns contribute to perceived safety in urban parks? In order to prepare a photo - questionnaire of the survey, there should be a systematic process to prepare scene, which is described in the following subsection.

Scene classification procedure

The scenes are prepared according to 3 planting patterns in urban parks in Tabriz as pre-discussed; therefore, the nature of the work is confirmatory. Landscape content of urban park was classified into three categories (Table 1).

Summer season was selected to take photos since vegetations of the parks have the maximum growth and fully covered in green. The scenes were collected from El Gholi Park and Big Park as predominant urban parks in Tabriz. These parks were selected because they have been known as the most famous and more used urban parks in Tabriz City; meanwhile, the problem of unsafe feeling still exists. The photos were taken from the soft - landscapes of the parks and hard-landscapes such as buildings, walkways, and other constructions were excluded. In addition, the scenes with slight construction in context were also excluded because the researcher believes that the scene includes landscape variety construction that might influence people's preference for plants. The photos were only captured when the place was cleared of users; therefore, the researcher waited until the place becomes free to prevent any effect on peoples' preferences. The photos were taken at the eye levels to avoid the effect(s) of various viewpoints. These photographs did not include any noise such as hard-landscape and presence of users. In the first stage, the photographs were grouped into the 3 planting patterns by landscape architects. In the next stage, the scenes were printed out on A3 size and colourful paper, whilst 4 scenes were located in each paper. Each group of planting pattern included 15 scene numbered from 1 to 15. A group of public (10 males and 10 females) ranked the scenes according to different content class (trees and shrubs with grass, trees and shrubs without grass, water, trees, and shrubs). The researcher explained to the participants to indicate the smallest number for more related scene. At the end of this part, 27 scenes (9 scenes for each label), those that received the highest agreement, were selected by the public participants. The results of public photo selection procedure were emailed to the experts in Universiti Putra Malaysia (UPM). These photos were grouped at three content classes (Trees and shrubs with Grass, Trees and Shrubs without Grass, Water, Trees, and Shrubs) and they were asked to rank the top five related photos at each planting pattern (1= strongly disagree to 5= strongly agree). From the result of the email survey, three scenes, those that received highest rank in each group, were picked up for final survey; however, 4 scenes were maintained for 'trees and shrubs with grass group because scenes number 3 and 4 received very close place based on the experts' ranking. All together, 10 scenes were selected for final survey presentation. The respondents were taken through using a systematic sampling method. Systematic sampling was used to select samples from the population because it provides a statistical base for stating this point that a sample is the representative of the target population (Fink, 2003). Among different methods, the systematic sampling method was proposed to be more suitable for sample selection, because the population is without name, so the other sampling methods are not applicable. In addition, the data were analyzed by using SPSS software.

Table 2. Participants' Backgrounds.

Participant		Number	Percent
Total public participation		296	100.0
Factors Sub-category			
Gender	Male	163	55.1
	Female	130	43.9
Marital status	Single	121	40.9
	Married	173	58.4
Age(years old)	19-29	140	47.3
	30-39	87	29.4
	40-49	36	12.2
	Above 50	30	10.1
Education	Secondary and below	25	8.4
	Under diploma	26	8.8
	Diploma	88	29.7
	University	152	51.4
Income(Toman)	Under 350,000	86	29.1
	Between 350,000 and 900,000	126	42.6
	Between 900,000 and 1,500,000	24	8.1
	Above 1,500,000	11	3.7
Occupation	Governmental employee	45	15.2
	Private sector	30	10.1
	Student	56	18.9
	Household	31	10.5
	Business	30	10.1
	Others	70	23.6

RESULTS

Demographic profile of the participants

Participants for this survey can be classified according to gender, marital status, age group, education level, income level, and occupation status. 296 questionnaires were collected in this study and males are $n = 163$ (55.1%) and females are $n = 130$ (43.9%) of the participants (Table 2). The data reflect the study by Nohorly (1999) where he shows that males are the main users of parks in Tabriz. Regarding marital status, the majority of participants ($n = 173$, 58.4%) are married and $n = 121$ (40.9%) are single. In terms of age groups, 47.3% ($n = 140$) are between 18 – 29 years, 24.9% ($n = 87$) are between 30-39 years, 12.2% ($n = 36$) are 40-49 years, and 10.1% ($n = 30$) of the participants are above 50 years.

For educational level, the data show the majority of the participants have university education ($n = 152$, 51.4%). For income status, the majority of the participants have income between 350 and 900 thousands Tomans. The

studies have shown that greater education (Kelly and Steinkamp, 1987; Hami, 2009) and high income (Kelly and Steinkamp, 1987) are associated with participation of leisure activities. The data show the participants vary when it comes to age groups, job classes and education levels

Plants' role in perceived safety

The participants were asked to rate items about plants' role in park safety by using 5 points Likert scale (1 = strongly disagree to 5 = strongly agree) and the question includes 6 items regarding plants' role in relation to criminal activity, alcohol drinking, drug usage, sexual attacks, presence of loiters, and scariness of planting areas. Gathering of addicted people in planting areas received the highest mean score (mean = 3.76, sd = 1.16), followed by "offenders can easily vanish among dense plantings" (mean = 3.68, sd = 1.18), and the item that received the lowest mean is "dense planting enhances the presence

Table 3. Mean analysis for plants' role in park safety.

Safety Dimensions	Label	N	Mean	Standard deviation	Alpha
1. Criminal activities	-	284	3.60	0.94	0.70
a) Criminal people can easily vanish among dense plantings	(SAFE 1)	290	3.68	1.18	
b) Addicted people mostly gather in areas with dense planting	(SAFE 2)	290	3.76	1.16	
c) High dense landscape has great potential for sexual attack	(SAFE 3)	290	3.38	1.26	
2. Undesirable activities	-	287	3.50	0.93	0.75
d) Darkness of planting areas makes me scared to go there	(SAFE 4)	291	3.57	1.25	
e) Crowded planting area offers safe and comfort place for drinkers	(SAFE 5)	294	3.49	1.17	
f) Dense planting areas have great potential to be used by loiters	(SAFE 6)	290	3.43	1.28	

Table 4. Mean ranking for perceived safety in landscape scenes by the public.

Scene number	Mean	Std. deviation	Scene number	Mean	Std. deviation
P1	4.24	0.93	P6	3.61	1.19
P2	4.21	0.95	P7	3.49	1.26
P3	4.20	0.87	P8	3.08	1.23
P4	4.15	1.07	P9	3.01	1.19
P5	3.66	1.16	P10	2.94	1.20

of dangerous animals like snakes' (mean = 3.16, sd = 1.23). Based on a result from reliability test, the safety items were grouped into two: undesirable effect ($\alpha = 0.70$) and design issue ($\alpha = 0.750$); so the groups have an internal consistency above 0.70 (Table 3). The mean value for these two dimensions 'criminal activities' and 'undesirable activities' shows slightly difference in which criminal activities have a mean of 3.60 (sd = 0.94) in comparison to undesirable activities with the mean of 3.50 (sd = 0.93).

It is argued that dense planting areas are suitable venue for anti-social and criminal activities. High dense planting areas do not look well maintained so less people might use the place, which makes a good place used for undesirable and criminal activity (Donovan and Jeffrey, 2012).

Preferences for landscape content

The participants also were asked to rate 10 landscape scenes in order to determine suitability of each landscape pattern for perceived safety by using 5 points Likert scale (1 = strongly disagree to 5 = strongly agree). From Table 4, the result reveals that the highest mean score is for the scene number 1 (mean = 4.24), followed by scene number 2 (mean = 4.21), scene number 3 (mean = 4.20), scene number 4 (mean = 4.15), and scene number 5 (mean = 1.16). Meanwhile, scene number 10 (mean = 2.94) is the least preferred.

Looking at Figure 1 depicts that the scenes number 2, 4, and 5 include water pool and the water looks calm and resembles a mirror that reflects the surrounding. The

water is also clean and no litter can be seen inside. In addition, the water view is expansive and not blocked in all directions; therefore, a person can view water ward without any obstacle. The scenes number 8, 9, and 10 contain trees and shrubs; no ground cover such as grass or lawn and water features. Meanwhile, the trees are crowded with high elevation and without big and broad crown. By looking at the mean rank, it can be argued that crowdedness of the trees planted plays a predominant role in perceived safety. The scenes with crowded planting pattern received fewer mean score for safety perception. A water feature, the second important element might also decrease safety feeling in the place and can be dangerous especially for children; nevertheless water attracts more people to visit park, which enhances social safety. The effect of ground cover such as grass and lawn similar to water feature might enhance perceived safety in parks.

As Table 5 shows the scenes were grouped into 3 groups according to alpha score in which all are greater than 0.70 and they are water, tree and shrub (mean = 4.00, sd = 0.72); tree, shrub, and grass (mean = 3.88, sd = 0.75) and the last group is tree and shrubs without grass (mean = 3.00, sd = 0.98). Based on the least preferred group, it seemed that people do not prefer scenes without water bodies, grass, and ground cover and the scenes with clean green cover and low dense plants are perceived safer than the scenes that lack them.

Regression result

Stepwise regression analysis was held to test the effect

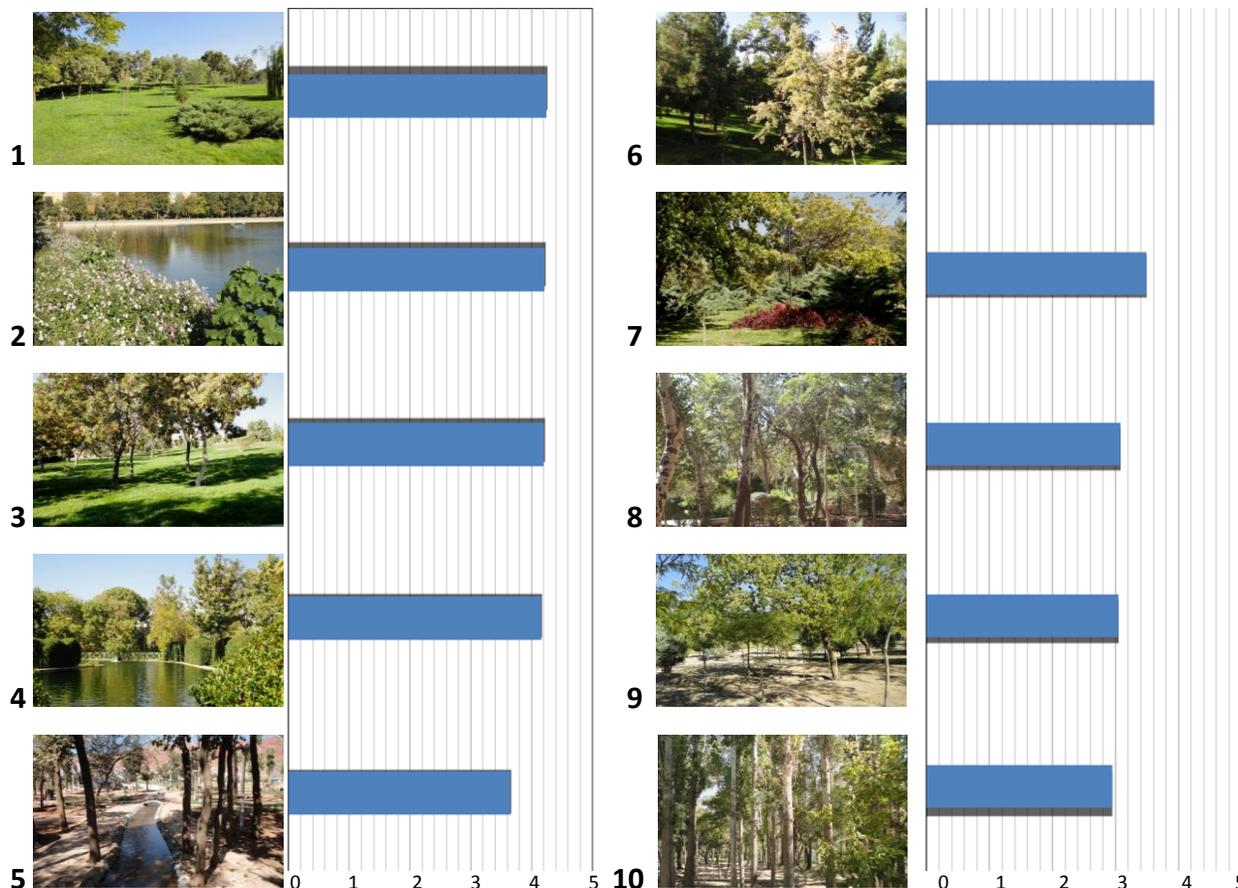


Figure 1. Rating of appropriateness of scenes for perceived safety among urban park users in Tabriz, Iran, ten Scenes Varying in Planting Pattern (number 1 has highest rank and number 10 has the lowest rank). Scale from 1 (strongly disagree) to +5 (strongly agree).

Table 1. Mean analysis for landscape scene groups of urban park.

Dimension	N	Mean	Std. Deviation	Alpha
Water, tree, and grass (scenes 2, 4, and 5)	284	4.00	0.72	.710
Tree and shrubs without grass (scenes 8, 9, and 10)	282	3.88	0.75	.750
Tree and shrubs with grass (scenes 1, 3, 6, and 7)	284	3.00	0.98	.720

of perceived safety on landscape characteristics and roles of plants for safety. 4 out of 7 perceived safety items showed correlation with 7 scenes out of 10 scenes (Table 5). The results indicate that scene number 5 correlates positively with hiding criminal people ($\beta = 0.19$), gathering addicted people ($\beta = 0.16$), presence of loiter ($\beta = .14$); scene number 7 with gathering addicted people ($\beta = 0.17$) and presence of loiter ($\beta = 0.17$) as well (Table 6). Moreover, scene numbers 6, 8, and 9 show significant negative correlations with perceived safety alternatives. For instance, scene number 8 has negative correlation with hiding criminal people ($\beta = -0.21$), scary place ($\beta = -0.22$), gathering addicted people ($\beta = -0.25$), and presence of loiters ($\beta = -0.20$). In addition, the scene

with deeper water pool was perceived to be unsafe place for the participants (scenes number 4, Figure 1).

Scene number 6 (Figure 1) shows significant negative effect ($\beta = - .019$) on the presence of loiters as safety item, scene number 9 discloses significant negative effect ($\beta = - 0.13$) on hiding criminal people. However, the R square scores of the models are not very high. As it is revealed, the scenes with water features (scenes number 2, 5, and 7, Figure 1) contribute positive effect on perceived safety. These scenes have large landscape view and water features while scene number 7 is more attractive because of colorful content. In addition, scene number 8 is correlated negatively with perceived safety dimensions.

Table 6. Stepwise regression results.

Variable	Antisocial behavior			
	Criminal people can easily vanish (SAF 1)	Gathering addicted people (SAF 2)	Scary place (SAF 4)	Presence of loiters (SAF 6)
Scene 2			+0.22	
Scene 4			-0.19	
Scene 5	+0.19	+0.16		+0.14
Scene 6				-0.19
Scene 7		+0.17		+0.17
Scene 8	-0.21	-0.25	-0.22	-0.20
Scene 9	-0.13			
R square	0.10	0.11	0.10	0.10

SAF 1 = Hiding criminal people, SAF 2 = gathering addicted people, SAF 4 = scary place, SAF 6 = presence of loiters.

Conclusion

The majority of the participants are males, married with university level of education. Similarly, more than 40% of them are 19-29 years old group with moderate income level. The participants exposed that high dense planting areas fit for criminal activity and gathering of drug addicted people. Lack of accommodations such as lighting system creates scary setting for people in urban parks as well. A safer scene is a landscape with vast and open view. Moreover, water features also showed positive effect on perceived safety. It can be regarded that water features draw more people into the place (Hami, 2009) and it can increase social surveillance and support. On the other hand, the landscape scenes with the most densely planted setting were perceived the least safe environment. They contained blocked visual views. A scene with blocked view seems to play important role in reducing perceived safety; perhaps it acts as a refuge zone, which allows criminals to hide. Similarly, the landscape scenes without lawn correlated with unsafe feeling in urban parks in Tabriz. In one study, the "fear-maps" sketched by college students showed that fear correlated with the presence of trees, shrubs, and walls that conceal view and limit escape alternatives (Fisher and Nasar, 1995). This result confirms expanding RA theory in landscape preference studies that plants' condition might decrease or increase the cost of criminal activity.

Implication of the findings

The findings expand application of routine theory in designing park landscapes in Iranian social context. The study claims that a landscape design should grant an adequate vision to drop more eyes in the areas. Due to increment confusion of landscape areas, irregular and disorganized plants pattern should not be made in the park sites. Vegetations such as shrubs and bushes should not be planted in spaces between trees. Meanwhile, in landscape areas without ground cover and lawn, the trees need to be planted far from each other in comparison to the landscape with lawn and ground cover. The

landscape scene with more varieties looks disorderly and complicated for the participants. Therefore, it is recommended to plant fewer varieties with high number of repetition rather than more varieties with low number of repetition.

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