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Evaluation of different wall design proposals based on user perception: the Izmit example in Türkiye

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Abstract
Surplus structures lead to wall problems in outdoor spaces. This makes people feel trapped between concrete masses. In this study, the walls in Izmit were examined. Activity areas in Izmit were determined as roadside, children's playground, sports area and resting area in which the wall is used intensively. The focal point was chosen as the visual quality of the walls in these areas. Visual quality is the user's appreciation or preference of the images of the walls before and after the design intervention. For each activity area, a total of 8 different wall examples of boundary and load-bearing walls were decided on, and design recommendations were developed using three different techniques of planting, constructiveness and planting–constructiveness. For each activity area, different intervention rates less (25–50%) or more (75–100%) were employed. Subsequently, the effect of these proposed designs on users and appropriate applications for different walls was revealed with the aid of a survey. In order to reveal the selection differences between the user group and the expert group, the survey was applied to 100 voluntary participants and an expert group of 10 landscape architects. As a result of the analysis, it was revealed that activity difference and the intervention rate were effective in the choice of intervention. Planting intervention design proposals were chosen for children's playground and roadside while constructiveness and planting interventions were chosen for resting areas. Also, constructiveness interventions were chosen for sports areas. On the basis of the results, activity type in the areas where the walls are located was found to be effective on choices. It is important to choose the appropriate intervention technique in accordance with the user's preference for the activity. Overall, this study aims to emphasize the necessity and importance of correct interventions to walls in order to illustrate the city more liveable, healthy and comfortable, providing aesthetic value in a visual sense compatible with the city.

Keywords Walls · Visual quality · Wall design · Visual pollution · Liveable city · User perception

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1 Introduction

Much research has revealed that nature is effective in reducing stress (Butterfield, 2014; Choe et al., 2020; Hartig et al., 2003). People are positively affected from a psychological aspect by being close to these types of areas, by having the opportunity to watch these areas, by active use of these areas, by knowing the areas are there even if they cannot see them and knowing that they can use these areas when they want (Kaplan, 1992; Ulrich & Parson, 1992; Özgüner, 2004; Markevych et al., 2017). Even visual images of nature provide significant degree of psychological benefit to people (Özgüner, 2004; Ulrich & Addoms, 1981). Stoneham et al. (1994) stated that natural areas positively contribute to people liking the environment in which they live, ensure their personal welfare and indirectly affect physical health gains. Research determined that natural areas provide many cognitive, emotional, behavioural, social and developmental benefits from a psychological viewpoint for individuals (Hewitt et al., 2013; Özgüner, 2004; Toone, 2010). In these times when close contact with nature reduces every day, research has revealed that nature keeps a city active and vibrant (Beatley, 2011; Lotfi et al., 2020).

Studies stated that living or spending time in natural areas reduces mental fatigue (Ewert & Chang, 2018; Hartig et al., 1991). Additionally, studies determined that watching nature and natural areas or spending time in these areas positively affects the psychological health of people and the physical problems that accompany these psychological problems (Butterfield, 2014; Choe et al., 2020; McManus et al., 2016). With nature and natural areas being so important for human health and psychology, the reduction in green space in city with every passing day negatively affects the city and its inhabitants (Özgüner, 2004).

Rapid population increase and the related unplanned and mistaken construction cause many problems such as obligating people to live in intense structural spaces and increasing the need for green spaces in cities (Aksu and Acar, 2011). Rapid urbanization causes the further destruction and reduction of green spaces in cities with every passing day, while population increase and associated density of structural elements in cities cause an increase and intensification of the urban resident's longing and need for nature (Ekren, 2017; Kahraman et al., 2018). Due to the reduction in green space and green space not meeting requirements, an increase is observed in psychological diseases like depression and stress among people (Sakıcı, 2014).

Leaving constructed masses in place of the reduced green space causes visual pollution to develop. One of the structural elements which causes visual pollution is walls. These concrete masses, assessed only in terms of functionality ignoring aesthetic values, cause negative effects on the psychology of people trapped between dense buildings and on visual quality in cities. Design interventions on the walls are important in terms of reducing the negative effects of the dense construction of the walls, minimizing the negative visual effects of walls found intensely in spaces, creating a more liveable city space compatible with the environment and contributing to the urban identity by adding aesthetic value to them. Design interventions to walls were revealed to provide positive contributions to cities in the sense of reducing psychological, climatic, ecological and environmental problems (Assimakopoulos et al., 2020). Completing both planting and constructive wall interventions to soften the solid and opaque effect of these walls assists in the creation of more liveable spaces in the city. Planting intervention on all kinds of vertical surfaces is called vertical garden.

Köhler (2008) indicated that the green areas of city centres should not be limited only to horizontal spaces, but should be formed on surfaces of buildings. Vertical gardens

offer a strategy for urban sustainable development with diverse benefits for urban quality of life and general well-being (Köhler, 2008; Loh, 2008; Valesan & Sattler, 2008). Vertical gardens are important design solutions to increase the decreasing amount of green space in cities. Vertical gardens have many functional benefits to the city such as improving air quality, reducing urban heat island impacts, providing noise, heat insulation and energy saving, creating microclimates, biodiversity (Rosenfeld et al., 1998; Yang et al., 2008; Ottele et al., 2010; Çakır et al., 2017; Timur et al., 2018; Meral et al., 2018; Alkan, 2020). Vertical gardens display both aesthetic and natural appearance in addition to their many functions and elevate the landscape quality of their environment (Eroglu & Basaran, 2017). Vertical gardens could be a tool to transform the skin of the city into a living landscape (Beatley & Newman, 2013; Green, 2004; Hartig, 2007; Lambertini et al., 2007).

How people perceive their environment and what they choose to consider and remember most can be determined and measured through the landscape preferences of individuals (Abkar et al., 2011). The perceptions and sentiments of individuals towards the environment may be associated with certain features of that environment (Polat & Akay, 2015). While researching the perception and preferences of individuals, importance should be given to the different spatial variables that affect landscape preferences (Acar & Sakıcı, 2008). Landscape perception is considered a subcategory of environmental perception and can be accepted as a function of the interaction between individuals and the landscape (Zube et al., 1982). Landscape quality arises from the relationships between the characteristics of the landscape and the effects of these characteristics on individuals (Daniel, 2001). In this study, the perception and the visual quality of existing and interfered walls and their effect on the user were investigated. The visual quality of landscape is one of the most important factors of the interaction between humans and nature. Visual landscape quality can be defined as 'relatively aesthetic impeccability of a landscape' and it can be measured through the appreciation of the observer (Daniel, 2001; de la Fuente de Val et al., 2006). Its measurement and evaluation is very difficult. The changing structure of the environment effects the user perceptions constantly and improvement of this visual character gains importance to meet human's aesthetic demands and expectations. In this study, visual quality is expressed as the user's appreciation or preference of the images of the walls before and after the design intervention.

The basic aim of this study is to reduce the negative effects of walls brought about by dense construction, to contribute to the city identity by providing them with aesthetic value, and to determine the user's perceptions and preferences of walls with different design interventions. Individuals spend the majority of their time between walls in enclosed environments. The majority of working environments and living environments comprise concrete structures. When individuals remaining for long periods in enclosed areas come into open areas and encounter walls once again, this causes psychologically negative effects (Karakoç, 2019; Lotfi et al., 2020). Completing both planting and constructive wall interventions to soften the solid and opaque effect of these walls (Aletta & Xiao, 2018) assists in the creation of more liveable spaces in the city (Lotfi et al., 2020; Mitrione & Larson, 2007). This study aimed to determine wall designs which offer visual beauty to the residents and assist in creating a more liveable city space compatible with the environment in order to minimize the negative visual effects of walls found intensely in spaces in the urban environment. With the help of this study, what should be considered in the interventions to the walls in different activity areas will be revealed with the example of Izmit. The effect of criteria such as the purpose of use of the area (activity), wall function (boundary and load-bearing), wall height (0–1.5 m, 1.5–3 m and 3 m and taller), interference density (less and

more) and intervention technique on the visual quality of the walls and user preferences will be revealed.

2 Material and method

Since there is heavy use of walls in Izmit and no intervention is made on these walls, intense structural spaces in the city are increasing day by day. For this reason, it was decided to conduct a study on the walls in the central county of Kocaeli province of İzmit. The activity pattern of users can be affected by the environmental factors in urban open green areas (Li et al., 2019; Rishbeth, 2004). The attitudes of users towards open green area can be influenced by the physical conditions of spaces. Thus, both the objective attributes and subjective psychology should be taken into account in green area design (Acar & Sakıcı, 2008; Li et al, 2019; Van der Berg & Koole, 2006; Van der Berg & Winsum-Westra, 2010; Zheng et al., 2011). For these reasons, it was decided to carry out a preliminary research in order to determine the functions and usage density of the walls in the city. Diagram of the methodology framework of the study is shown in Table 1. All walls within the city were investigated and the spaces where the walls were used in, the activities carried out in spaces, their aim of use and wall heights (three separate categories of 0–1.5 m, 1.5–3 m and 3 m and taller) were determined in preliminary research. When determining wall height categories, the heights of walls present in the city were measured and categories were determined linked to the wall heights commonly used. As a result of the preliminary research, walls were intensely used along roadsides, in children's playgrounds, in sports areas and resting areas and that walls had load-bearing and bounding properties in Izmit. Then, walls in these four different activity areas was investigated and the general functions and heights of walls in these areas were examined and photographed. The mean height distribution of walls in these spaces linked to functions are given in Table 2. Wall surfaces were determined for each activity area, one load-bearing and one boundary. These 8 different wall surfaces were selected based on the determined height distribution by a group of 7 landscape architects from a total of 66 images (Fig. 1). The neighbourhood distribution of these wall surfaces determined as study material in Izmit, containing a total of 57 neighbourhoods, is shown in Fig. 2.

There is a relationship between environmental design and human preferences (Li et al., 2019). Within the scope of the study, in order to determine the effect of different wall designs in different spaces on the user, design proposals were developed with the help of Adobe Photoshop cs6 program for these 8 different images, which were determined depending on the activity, wall type and wall height. Much research benefits from simulation studies in order to determine the effect of visual images (Suresh et al., 2011; Bitter & Corral, 2014; Bower et al., 2014; Pasini et al., 2014; Uzunboylu & Yılmaz, 2016; Akçayır & Akçayır, 2017; Piga, 2017; Torbati, 2018; Kerr & Lawson, 2020; Lotfi et al., 2020). For each activity area with design proposal developed, three different choices were produced for intervention of planting alone, constructiveness alone and both planting and constructive interventions for different wall uses (load-bearing, boundary). Researchers often prefer these intervention techniques in studies that use simulation studies to determine the effect on the user (Barnhart et al., 1998; Purcell et al., 1994; Sakıcı, 2009; Whitehouse, 1999). The constructiveness intervention within the scope of the study involved two- or three-dimensional interventions to the surface of the walls with different materials or paints to increase visual quality. The planting intervention involved common climber, wrapper,

Table 1 Diagram of the methodology framework

Preliminary research	Determining the spaces where the walls are used intensively							
	Determination of activity in the area where the wall is located							
	Determination of wall heights							
	Determination of wall functions							
According to preliminary research, spaces with the most wall surface								
Spaces	C. playground		Resting area		Sports area		Roadside	
Wall function	Load-bearing	Boundary	Load-bearing	Boundary	Load-bearing	Boundary	Load-bearing	Boundary
Average wall heights	1,5–3	0–1,5	3 or taller	0–1,5	3 or taller	1,5–3	3 or taller	0–1,5
	Determination of 8 different wall images linked to activity, wall type and wall height							
Simulation studies in order to determine the effect of visual images								
	Determination of intervention techniques to be applied to these images							
Intervention Techniques	Constructiveness		Planting			Constructiveness–planting		
	Determining the intervention rates to be applied to these images (For wall within each different activity area, more and less intervention rates were used)							
Intervention Rates	Less Intervention				More Intervention			
	% 0–25		% 25–50		% 50–75		% 75–100	
	Development of Design proposals with the aid of the Adobe Photoshop (8 wall images * 3 different intervention techniques = 24 different desing proposals)							
Assessment of proposed designs for different activity areas by participants								
Survey method	Determining which intervention techniques are preferred for different activity areas							
	Determining the reasons for this preference							
	Determining the effect on users of different intervention techniques applied to the walls							
	11 adjective pairs				7-point Likert scale			
Participants	User group				Expert group			
4 images assessment	The current state		Constructiveness proposed design		Planting proposed design		Constructiveness -Planting proposed design	

Table 1 (continued)

Chi-square analysis	Determining the effect of wall functions linked to activity on preference
	Determining the effect of intervention rates on the choice of intervention technique

Table 2 Height distributions of walls in different categories and intervention rates in simulation studies

Spaces	Load-bearing walls		Boundary walls	
	Wall height (metres)	Intervention rates	Wall height (metres)	Intervention rates
Children playground	1,5–3	%25	0–1,5	%75
Resting area	3 or taller	%75	0–1,5	%50
Sports area	3 or taller	%50	1,5–3	%100
Roadside	3 or taller	%100	0–1,5	%25

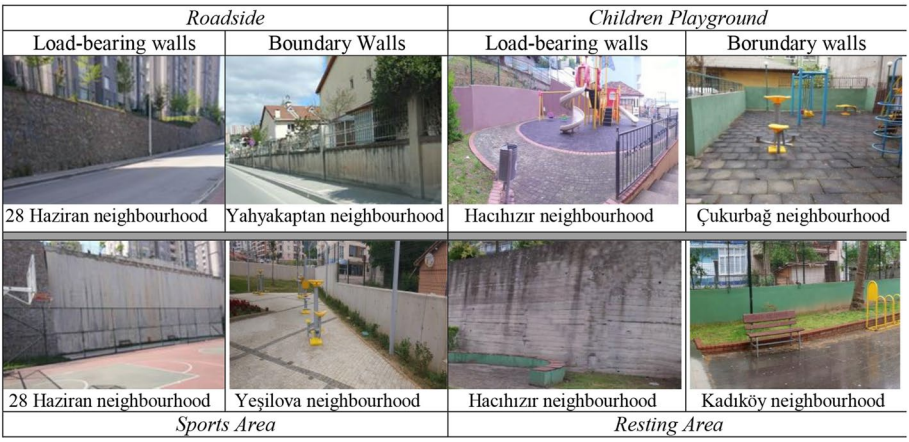

Fig. 1 Walls determined as study material and neighbourhood locations

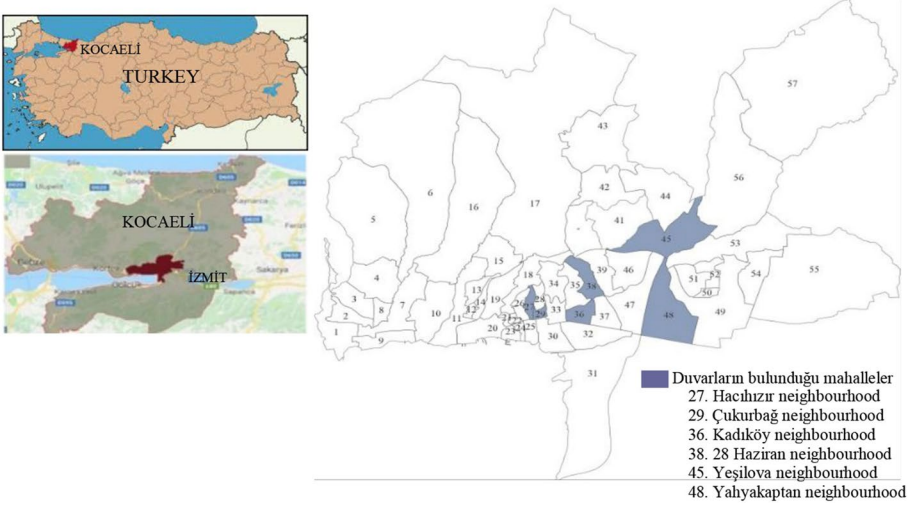

Fig. 2 Study area and distribution of investigated walls on a neighbourhood basis

creeper and spreading plants on the wall surface within panel systems, metal fence system or modular systems. The planting and constructiveness intervention involved the use of planting and structural elements together.

A total of 24 (8*3) different design proposals created for the determined walls (Fig. 3). When producing the choices for the two different wall uses in each activity area, intervention rates involving less or more intervention were used in order to examine whether this affected choices. When developing the design proposals, intervention to 25–50% of the wall surface area was less intervention, while intervention to 75–100% of the wall surface was assessed as more intervention within the scope of the study. These intervention percentages are used in many studies (Acar et al., 2006, 2013; Acar & Sakıcı, 2008; Sakıcı, 2015). Care was taken to apply all the four different intervention rates to both load-bearing and boundary walls. The wall heights of images chosen within the scope of the study and the intervention rates applied to walls during simulation studies are given in Table 2. Among the chosen wall surfaces, load-bearing walls comprised three walls with height 3 m or taller and one with height 1.5–3 m, and boundary walls comprised three walls with height 0–1.5 m and one with height 1.5–3 m. These wall heights were chosen according to commonly used wall heights linked to the activity areas identified during preliminary investigation in the neighbourhoods of the central county. Diagram of the methodology framework of the study is shown in Table 1.

The survey method was used to determine the visual quality and its effect on the users of the different design proposals created for each wall. The survey was conducted in Izmit Kocaeli in Turkey. According to the data of 2021, the population of Izmit is 371 thousand 2 people. The minimum sample size was found to be 96 people at the 96% confidence level and 0.5% standard deviation. The survey study was carried out on 100 people. In order for the evaluations to be objective, the walls in each different activity area were evaluated by the same people. In this respect, a survey was conducted in these areas with 100 random volunteers used at least one of these determined activity areas, and they were asked to answer the survey questions with the help of wall images in which different intervention techniques were made in other activity areas. Participants were selected on a completely voluntary basis. It is important to choose an intervention technique depending on the desired effect on the user when intervening on the walls. The professional group that makes wall designs using different techniques is landscape architects. It is important to choose an intervention technique depending on the user's preference while intervening on the walls in terms of fulfilling the function of the activity area. It is important that designers begin the design beyond their own thoughts by noting the desires and requirements of the users when developing wall designs linked to activity areas. Otherwise, these areas cannot fulfil their intended use, are not used and remain empty. Landscape architects should make wall designs by taking into account the user's wishes and needs, rather than their personal tastes. For this reason, the wall design proposal preferences of both the user group and the designer group in different activity areas should be revealed. In this respect, the same questionnaire was applied to landscape architects to reveal whether the preferences of the user group and the expert group were similar. Therefore, a 10-person expert group comprised of landscape architects assessed the same design recommendations in this study and differences in selections between the user group and expert group were examined. Photographs of each design proposal created for each wall were used in answering the questionnaire questions. There are a number of studies proving that photographs have representative validity for assessment of landscape qualifications and these studies demonstrate that there is high coherence and parallel responses between photography-based perceptual decisions and directly perceived landscapes (Abkar et al., 2011; Arriaza et al., 2005; Bernasconi

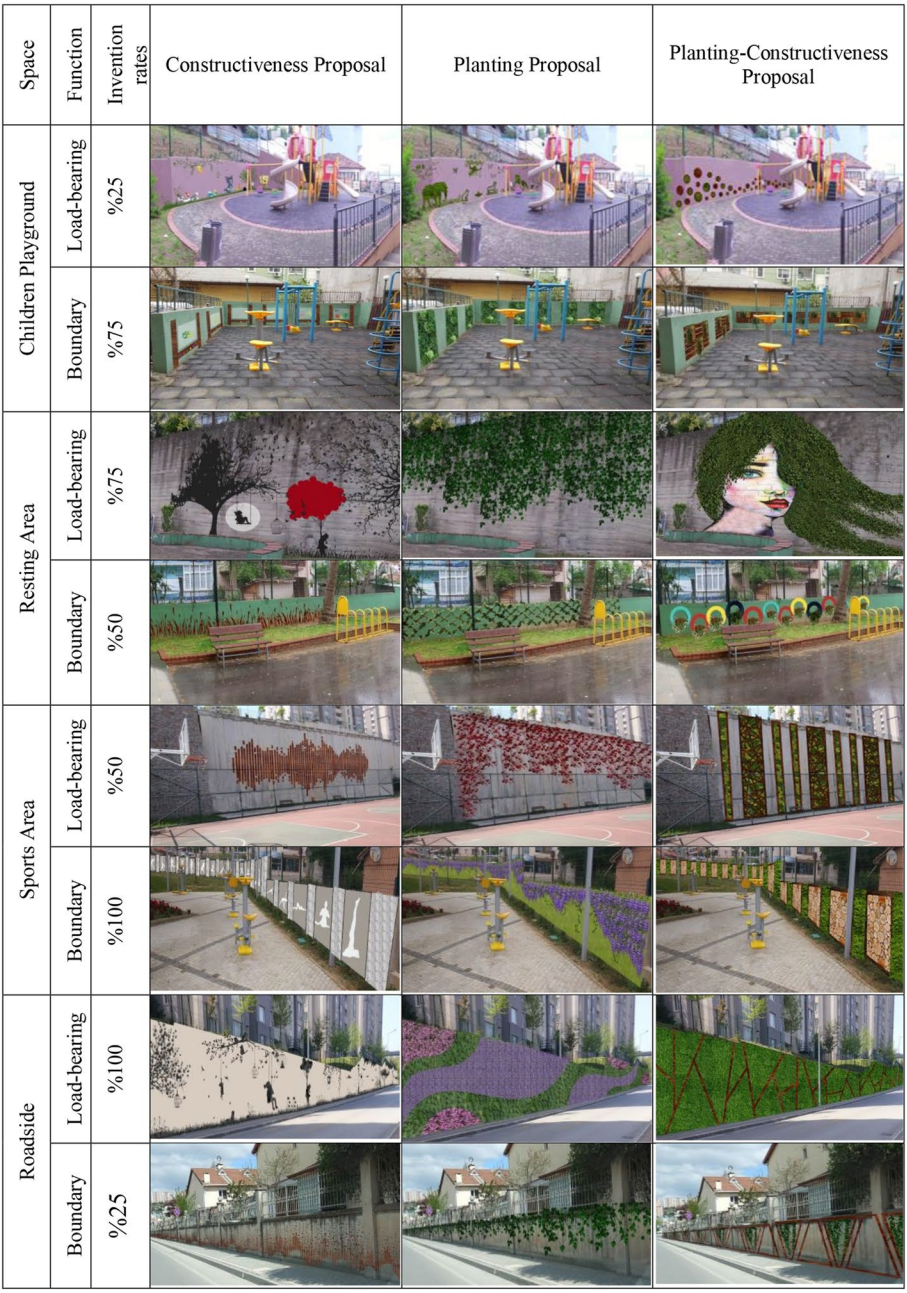

Fig. 3 Wall design proposals linked to wall functions in different spaces

et al., 2009; Clay & Daniel, 2000; Clay & Smidt, 2004; Hedblom et al., 2020; Lotfi et al., 2020; Nasar & Lin, 2003; Olszewska et al., 2018; Palmer & Hoffman, 2001; Sakıcı & Var, 2014). The survey comprised three sections. The first section included questions about

demographic characteristics of users; the second section asked about which choice of constructiveness, planting and constructiveness–planting intervention users would select and reasons for their choices. The preference distributions of the proposed design techniques for each area are given as percentages. In order to determine the reasons for preference, 7 different reasons were given by the researchers and they were asked to choose among them. The final section included assessment of the effects caused by the current state of each area and the three different design proposals on users. In order to determine the effect of the proposed designs on the user, 11 adjective pairs were used and a 7-point Likert scale was used in the evaluation. With the aid of Chi-square analysis, the presence of differences in choices related to constructiveness, planting and constructiveness–planting design proposals linked to intensity of intervention to the walls, activity completed in the area and the purpose of the wall (load-bearing, boundary) were revealed.

3 Results

3.1 Demographic characteristics of users

In order to determine the effects on users of the recommendations created for walls in different spaces, a survey study was performed on 100 area users residing for long periods in the central county and with balanced female–male distribution. Additionally, in order to determine whether there were differences between the user group and expert group, an expert group comprising 10 landscape architects were questioned about which wall design recommendation they would choose and for what reason. The demographic characteristics of users and expert group participating in the survey are given in Table 3. Of participants, 51% were female and 56% were in the 18–35-year age group. The expert group comprised 70% women and all were in the 18–35 year age group.

3.2 Assessment of proposed wall designs by users

Three design proposals were created with constructiveness, planting and both constructiveness and planting interventions at certain rates for a total of 8 different walls comprising four load-bearing walls and four boundary walls in four different activity areas. It was

Table 3 Demographic characteristics of survey participants

Demographic features (%)		Users	Expert group
Gender	Male	49	30
	Female	51	70
Age range	18–35 (young)	56	100
	35–50 (middle age)	32	0
	50 ve üstü (old)	12	0
Education level	Primary school	10	0
	Secondary school	16	0
	High school	36	0
	University	34	0
	Postgraduate	4	100

researched that which design proposal was preferred for which activity area and why. Thus, it will be examined whether the activity areas have an effect on the preference.

According to user group assessment, for the children's playground, the proposed designs with planting intervention were chosen at 41% and 50% rates for both load-bearing and boundary walls, respectively. For the resting areas, the proposed designs with planting–constructiveness interventions were chosen at 51% and 46% rates for both load-bearing and boundary walls, respectively. For the sports areas, design proposals with constructiveness intervention were chosen at 38% and 52% rates for both load-bearing and boundary walls, respectively. For roadsides, design proposals with planting interventions were chosen at 60% and 54% rates for both load-bearing and boundary walls, respectively.

According to expert group assessment, for the children's playground, the proposed designs with planting–constructiveness intervention were chosen at 40% for load-bearing walls and planting interventions were chosen at 70% rates for boundary walls. For the resting areas, the proposed designs with planting interventions were chosen at 50% for both load-bearing and boundary walls. For the sports areas, design proposals with planting–constructiveness interventions were chosen at 50% for load-bearing walls and planting interventions were chosen at 50% rates for boundary walls, respectively. For roadsides, design proposals with planting interventions were chosen at 50% and 60% rates for both load-bearing and boundary walls, respectively.

The results revealed that there are differences between the preferences of the user group and the preferences of the expert group. While the expert group preferred either planting intervention or planting–constructiveness in all areas, the preferences of the user group changed depending on the activity areas. Planting intervention design proposals were chosen by users for children's playground and roadside, both constructiveness and planting interventions were chosen for resting areas and constructiveness interventions were chosen for sports areas. While the expert group showed a preference change depending on the wall function change in the same activity area, the function of the wall (load-bearing and boundary walls) was not taken into consideration in the preferences of the user group. It is important to choose an intervention technique depending on the user's preference while intervening on the walls in terms of fulfilling the function of the activity area. In this respect, the expert group should make wall designs depending on the activity, in line with the user's wishes and needs, rather than their own preferences. Otherwise, these areas will not be used for their intended purpose and will remain empty.

The selection rates for proposed designs and the reasons for choices for the 4 different activity areas are given in Table 4. When reasons for selection are examined, among all selections, the first place among reasons was high visual quality and the majority were chosen due to displaying relaxing, restful effect. In the expert group, apart from these criteria, the criteria of natural appearance, creative original attractive design and special design suitable for function were revealed to be effective. It has been revealed that visual images with high visual quality are preferred by users.

In order to determine whether wall functions linked to activity were effective on choices within the scope of the study, Chi-square analysis was performed and whether the wall was load-bearing or boundary was not effective on choices according to the analysis results (for children's playground $p=0.105$, for resting area $p=0.207$, for sports area $p=0.112$ and for road side $p=0.092$). When it was understood that wall functions did not affect choices, the Chi-square analysis was used again without regard to wall functions in order to determine whether there was a significant difference in choice distributions for activity areas linked to present status of each wall and the three different proposed designs created with constructiveness, planting and constructiveness–planting interventions. It was revealed that activity

Table 4 Assessment of proposed designs for different activity areas by participants

Intervention rate		%25		%75		%75		%50		%50		%100		%100		%25	
Spaces		CPL* (%)		CPB* (%)		RAL* (%)		RAB* (%)		SAL* (%)		SAB* (%)		RSL* (%)		RSB* (%)	
U:Users group/E: Expert group		U	E	U	E	U	E	U	E	U	E	U	E	U	E	U	E
Preference	Planting	**41**	30	**50**	**70**	15	**50**	25	**50**	31	20	30	**50**	**60**	**50**	**54**	**60**
	Constructiveness	39	30	25	10	34	10	29	20	**38**	30	**52**	10	26	0	20	0
	Planting–constructiveness	20	**40**	25	20	**51**	40	**46**	30	30	**50**	17	40	13	50	26	40
	Current state	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0
Reason for preference	High visual quality	**79**	50	**77**	40	**89**	**100**	**76**	**70**	**78**	**70**	**83**	**50**	**90**	**90**	**74**	**60**
	Special design suitable for function	**77**	**60**	52	40	63	**70**	61	**60**	55	50	**69**	30	63	60	51	**60**
	Environmental compliance	**74**	**70**	**73**	40	60	50	**75**	**60**	58	20	**69**	**70**	70	**70**	66	**60**
	Relaxing, restful effect	67	**70**	**73**	**70**	**75**	**80**	**73**	30	**64**	**60**	66	30	**74**	40	**68**	**60**
	Natural appearance	63	30	62	**50**	67	40	66	50	**62**	20	59	40	**73**	40	**69**	50
	Creative original attractive design	53	**60**	49	**50**	**75**	50	43	30	60	**70**	58	40	58	**70**	54	40
	Providing comfort	31	30	27	30	34	40	32	20	37	10	35	10	38	40	33	20

**CPL* children playground load-bearing walls; *CPB* children playground boundary walls; *RAL* resting area load-bearing walls; *RAB* resting area boundary walls; *SAL* sports area load-bearing walls; *SAB* sports area boundary walls; *RSL* roadside load-bearing walls; *RSB* roadside boundary walls

Bold values indicate most preferred

types were effective on choices ($p < 0.00$) and intervention technique should be preferred depending on the activity types as a result of the analysis. Planting intervention design proposals were chosen by users for children's playground and roadside, both constructiveness and planting interventions were chosen for resting areas and constructiveness interventions were chosen for sports areas. It has been demonstrated with the help of this study that the function of the wall is not important when design interventions are made on the walls, but the activity in the area where the wall is located has an effect on the preference.

Within the scope of the study, the presence of a significant difference in choice distribution for the three different proposed designs linked to intervention intensity on the walls was examined. It was revealed that the intensity of the intervention (as %) had significant effect on the choices related to intervention techniques ($p < 0.00$) and the intervention intensity should be preferred depending on the intervention technique as a result of the analysis. When intervention intensity was 25% and 100%, planting proposal designs were chosen, and when it was 50% and 75%, constructiveness–planting proposal designs were chosen. Thus, it was revealed that the intervention rate was effective in the selection of the intervention technique to be made on the walls. Results are given in Table 5.

As a result, it has been revealed that the wall function is not considered in the selection of the intervention technique to be made on the walls, but the activity in the area where the wall is located is important and the preferences should be made in this direction. In addition, it has emerged as a result of the study that the intensity of the intervention should be determined depending on the choice of intervention technique, and thus, walls with higher visual quality can be created.

In order to determine the effect induced in users by the current status and by the proposals for both load-bearing and boundary walls in four different activity areas, 11 adjective pairs were used and assessment used a 7-point Likert scale. The effect on users of the design proposals and current status of walls for both load-bearing and boundary walls in the four different spaces is given in Fig. 4. When graphs are examined, it appears that the current status of walls in all areas with different functions were given points in favour of negative concepts, while all proposed designs were given points in favour of positive concepts, with significant point differences between them. Here, all proposed designs for walls have much higher visual effect compared to the present status. For the children's playground, the most commonly chosen planting intervention from the three choices with 25% intervention rate applied to the load-bearing wall and 75% intervention rate for the boundary wall was rated with highest positive concepts compared to the other choices. For the resting area, the constructiveness–planting intervention proposal was chosen most from the

Table 5 Effect of intervention intensity of proposed designs on choices

		Intervention rates				*p*
		25%	50%	75%	100%	
Techniques	Constructiveness	59	67	59	78	0,000
		29,5%	33,5%	29,5%	39,0%	
	Planting	**95**	56	65	**90**	
		47,5%	28,0%	32,5%	**45,0%**	
	Constructiveness–planting	46	**76**	**76**	30	
		23,0%	**38,0%**	**38,0%**	15,0%	

Bold values indicate most preferred

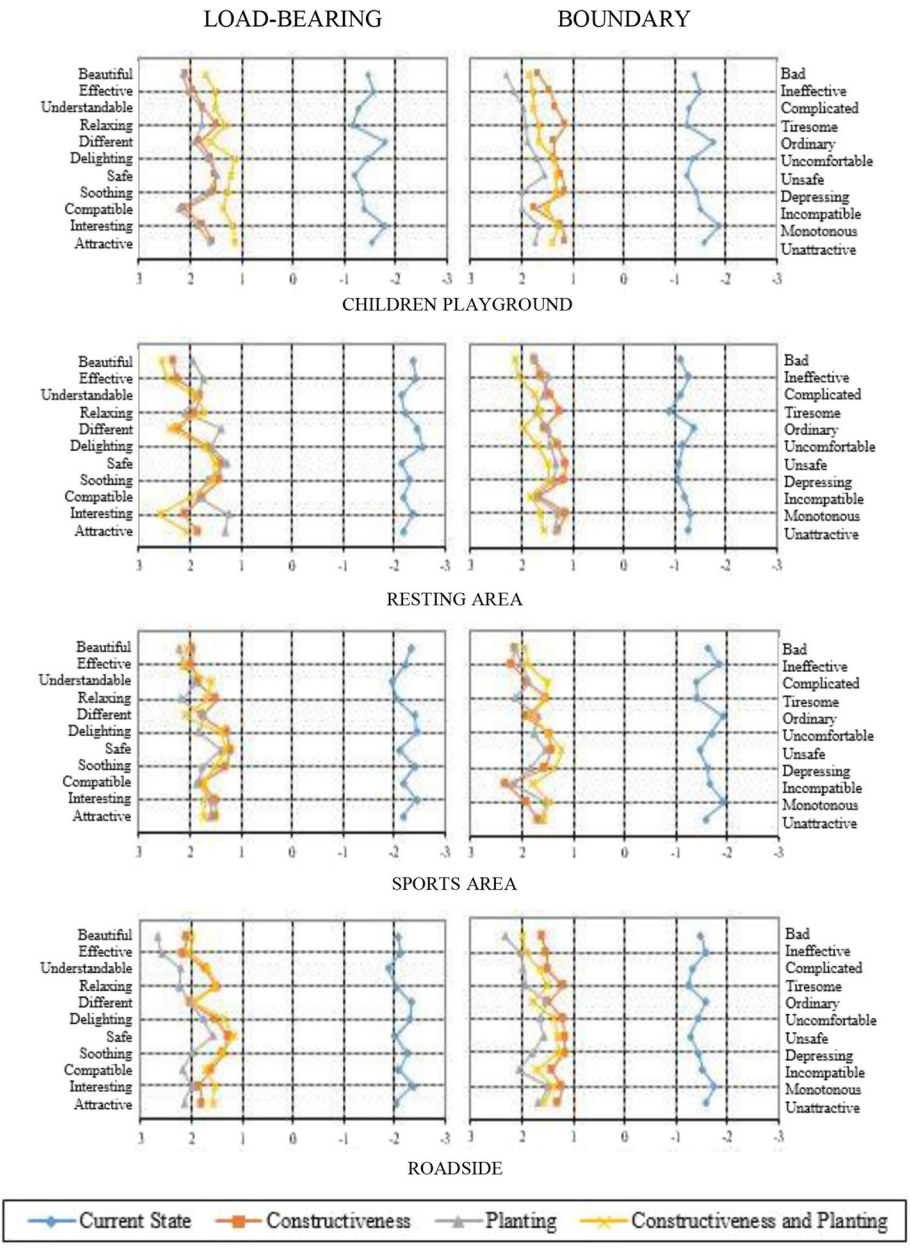

Fig. 4 Effect of walls in different spaces on users

three choices, with 75% intervention rate for the load-bearing wall and 75% intervention rate for the boundary wall, and had highest points for all concepts, apart from the relaxing concept, compared to other choices. For the sports area, the constructiveness intervention proposal most commonly chosen from the three choices with 50% intervention to the load-bearing wall and 100% intervention to the boundary wall did not have high points

for several concepts, but had higher points for the 'different' concept among implementation proposals. For the roadside, the planting implementation chosen most from the three choices with 100% intervention rate for load-bearing wall and 25% intervention for boundary wall had higher points for all concepts, apart from the 'different' concept, compared to other choices. Thus, with this study, it was revealed that the effects of different intervention rates on the walls of different functions in each activity area differ on the user, and it was determined how each wall intervention affected the user.

4 Discussion and conclusion

Increasing construction with each passing day in cities has left concrete structures in place of green spaces. Currently, one of the problems in cities is visual pollution created by walls with no importance given to appearance and the negative effects of these walls on the city and people living in the city (Aksu & Acar, 2011; Lotfi et al., 2020). As a result, the effect of the intense use of walls in cities experiencing loss of green space, especially in recent years, on the city silhouette is among important topics requiring research.

According to the results of the study, walls located in developing areas, especially, in Kocaeli's central county of İzmit, have not had sufficient interventions performed, negatively affect people living in the region and cause visual pollution due to the lack of any attractiveness in a visual sense. When the walls in this central county are investigated, use as both boundary and retaining walls is common and the study determined that these walls were intensely used in urban open green spaces like children's playgrounds, resting areas, sports areas and roadsides. There is a relationship between environmental design and human preferences (Acar et al., 2021; Li et al., 2019). Within the scope of this study, all constructiveness, planting and constructiveness–planting proposals for the load-bearing and boundary walls in these four different activity areas were determined to be liked by users. In order to reduce the negative effects caused to urbanites by walls, the design interventions to these wall surfaces also included planting interventions which will positively contribute to the green space requirements of the city. Lotfi et al. (2020) revealed that vertical gardens affected users, increased urban quality of life and general welfare, reduced stress and had improving and restorative effect in a study about solution proposals to increase green space in areas with limited amounts of green space. Aksu and Acar (2011) stated that planting and constructiveness interventions to retaining walls provided aesthetic value to the location. Design interventions to walls were revealed to provide positive contribution to cities in the sense of reducing climatic, ecological and environmental problems (Assimakopoulos et al., 2020). The results of this study revealed that constructiveness, planting and constructiveness–planting interventions to walls created positive effects on the available visual quality of the wall and on users. In addition, the criteria that should be considered during the intervention on these walls were determined one by one.

As revealed in many studies (Aksu & Acar, 2011; Lotfi et al., 2020), walls without any intervention negatively affect people and people were uncomfortable due to these walls according to the results of this study. The importance of interventions to be performed on these wall surfaces for the city and people living in the city has been demonstrated with the aid of this study. Vertical gardens, attracting much more attention in recent times and with expanding areas of use, add value to a city in the aesthetic sense, induce improving and restorative effects on people living in the city and were determined to have positive effects on psychology (Ulrich, 1991; Marcus & Barnes, 1999; Butterfield, 2014; Çelik et al., 2015;

Ekren, 2017; Karakoç, 2019; Lotfi et al., 2020). Vertical gardens undertake functions like softening extreme climatic conditions, reducing urban heat islands and increasing air quality which increase the urban quality of life (Alkan, 2020; Yang et al., 2008). Vertical gardens can transfer nature to the vertical plane of the wall surface ensuring continuity (Beatley, 2011; Karakoç, 2019). Vertical gardens providing a decorative appearance to walls are also green textures providing the appearance of a modern structure (İpekçi &Yüksel, 2012; Karakoç, 2019). Vertical gardens may transform a city appearance into a living landscape (Beatley, 2011; Blanc, 2008; Green, 2004; Lambertini et al., 2007; Lotfi et al., 2020). Because of these benefits, studies have generally focused on planting interventions on walls. Many studies revealed that employees in areas that have undergone planting on structural surfaces provided higher yield, were more productive and less stressed (Hum & Lai, 2007; Kondo et al., 2015; Lohr et al., 1996; Lotfi et al., 2020). Additionally, studies about visual choices revealed that areas with natural or planting interventions were chosen more often (Acar & Sakıcı, 2008; Bernasconi et al., 2009; Clay & Daniel, 2000; Polat & Akay, 2015). Erdoğan et al. (2008) performed planting interventions to facades and revealed that these interventions provided value in an aesthetic and economic sense. They emphasized that these interventions benefited urban ecology and the health of people living in the city. Kırıt and Sağlık (2018) determined that vertical gardens increased quality of life and the increasing construction everyday increased the need for green space. In this sense, vertical gardens meet this green space requirement and induce positive effects on visual quality. Timur et al. (2018) studied bridge walls and proposed that planting interventions to these walls will increase the aesthetic quality of the bridge and that implementing their study would create positive effects on the quality of life in the city. As understood from these studies, planting interventions to walls create positive impacts on the city and urbanites. The results of our study are parallel to these studies, revealing that there was interest and selection of not just planting interventions but also constructiveness interventions and this result ensured the possibility to examining interventions to wall surfaces from a different viewpoint. People generally tend to prefer the areas with more natural elements (Chou et al., 2016; Kaplan, 2001). Natural intervention may affect users' environmental preference in the urban area (Van den Berg et al., 2007). Human structures and artificial elements negatively affect the visual quality of landscapes (Arriaza et al., 2004; Clay & Daniel, 2000; Hami & Abdi, 2021). From this point of view, elements such as surface pavement materials and artificial elements are expected to have a negative effect on the visual quality of the landscape. However, some studies held the opposing opinion referring to the relationship between landscape environment and human preference. Parsons suggested that ecologically natural landscapes are perceived to be less attractive (Parsons, 1995). Our study did not produce negative results associated with constructiveness interventions. The reason for this may be that the walls are constructions at present and have low visual quality and that any intervention to the walls, no matter what, will positively affect visual quality. Additionally, with the aid of this study, positive effects may be induced in individuals and on the urban image as a result of correct interventions to walls and the aim should be to see and acquire walls, used only functionally, in an aesthetic sense for the city. Constructiveness, planting and both constructiveness and planting interventions will increase the quality of urban life and landscape quality and will have positive effects on the visual quality of the walls. In addition, it has been determined that the effect of different intervention techniques on the user differs. It is important to choose an intervention technique depending on the user's preference while intervening on the walls in terms of fulfilling the function of the activity area.

According to the results of the study, activities completed in the areas where the walls are located were effective on choices. The activity pattern of users could be affected by the environmental factors of urban open green areas (Li et al., 2019; Rishbeth, 2004). The attitudes of users towards open green areas are influenced by the physical conditions of spaces (Acar et al., 2021). Thus, both the objective attributes and subjective psychology should be taken into account in green area design (Acar & Sakıcı, 2008; Acar et al., 2021; Li et al., 2019; Van der Berg & Koole, 2006; Van der Berg & Winsum-Westra, 2010; Zheng et al., 2011). In spite of studies showing variability of user choices linked to the activity completed (Barnhart et al., 1998; Purcell et al., 1994; Sakıcı, 2009; Whitehouse, 1999), no such study has been performed on walls. In this study, the activities carried out in the areas with the walls were found to be effective on user preferences. This result reveals the importance of the study, as walls have not been previously assessed linked to activity. According to the study results, for children playground, planting design proposals were chosen at rates of 41% and 50% for load-bearing and boundary walls for high visual quality, inclusion of special designs and compatibility with the surroundings. For resting areas, high visual quality, a restful relaxing effect and compatibility with surroundings led to selection of constructiveness–planting design proposals at rates of 51% and 46% for load-bearing and boundary walls. For sports areas, construction design proposals were chosen at rates of 38% and 52% for both load-bearing and boundary walls due to high visual quality. For roadsides, planting design proposals were chosen at rates of 60% and 54% for load-bearing and boundary walls due to high visual quality, inducing restful relaxing effect and displaying natural appearance. If the assessments of wall recommendations by the expert group (landscape architect) are examined in general, constructiveness recommendations were not chosen for any activity area, with only planting–constructiveness interventions chosen for load-bearing walls in the children's playground and sports area and planting interventions chosen for all other areas.

In summary, the results revealed that there are differences between the preferences of the user group and the preferences of the expert group. While the expert group preferred either planting intervention or planting–constructiveness in all areas, the preferences of the user group changed depending on the activity areas. This situation is thought to be due to the environmental approach of landscape architects. While the expert group showed a preference change depending on the wall function change in the same activity area, the function of the wall (load-bearing and boundary walls) was not taken into consideration in the preferences of the user group. It is important to choose an intervention technique depending on the user's preference while intervening on the walls in terms of fulfilling the function of the activity area. It is important that designers begin the design beyond their own thoughts by noting the desires and requirements of the users when developing wall designs linked to activity areas.

The results of the study found that planting design proposals were chosen for children's playgrounds and roadsides, while construction design proposals were chosen for sports areas and constructiveness–planting implementations were chosen for resting areas. In Summary, the activities carried out in the areas with the walls were found to be effective on user preferences. Thus, the need to perform interventions to walls linked to the activity area was revealed. The activity pattern of users can be affected by the environmental factors of urban open green areas (Acar et al., 2021; Li et al., 2019; Rishbeth, 2004). Based on this, the results of the study revealed the need to determine the intervention technique linked to the activity completed in the space where the wall is located, without regard to the function of the wall, for interventions to be performed to increase the visual quality of walls. This result is the most important outcome differentiating

this study from other studies. In addition, although landscape architects generally prefer planting intervention or planting–constructiveness intervention, they should definitely consider user preferences when designing wall interventions.

Additionally, the intensity of intervention to walls when developing design proposals was effective on choices, with planting designs chosen when intervention intensity was 25% and 100%, and constructiveness–planting design proposals chosen when intensity was 50% and 75%. Li et al. (2019) revealed that vegetation density had a positive effect on preference. This situation reveals that when an intervention is going to be very small (25%) or very intense (100%), planting interventions are chosen and that if an intervention is going to have moderate intensity (50–75%), constructiveness–planting interventions are chosen more often. Therefore, this study reveals that it is necessary to choose the intensity of the intervention depending on intervention technique while making design proposals for the walls.

As a result, increasing construction with each passing day in cities has left concrete structures in place of green spaces. Currently, one of the problems in cities is visual pollution created by walls with no importance given to appearance and the negative effects of these walls on the city and people living in the city. It is not sufficient for construction engineers alone to have a say in the design stage when constructing walls, the importance of multidisciplinary studies is clear. As a result of the study, it has been revealed that when constructiveness, planting and both constructiveness and planting interventions are made on these walls, the visual quality increases and it creates positive effects on the user. Considering the contribution of wall design to the city and urbanite, there is a definite need to include landscape architects in configuration of these designs and to include design proposals linked to the space where the wall is located and intensity of intervention and in line with user wishes and needs. It has been revealed that the wall function is not considered in the selection of the intervention technique to be made on the walls, but the activity in the area where the wall is located is important and the preferences should be made in this direction. In addition, it has emerged as a result of the study that the intensity of the intervention should be determined depending on the choice of intervention technique, and thus, walls with higher visual quality can be created.

Considering the fact that this study was limited to only four activity areas, It is very important to carry out similar studies for the walls in other activity areas in order to transform the walls into surfaces that contribute positively with the right wall interventions and to create livable environments. In this respect, a very limited number of wall intervention studies should be expanded.

In summary, the following results were obtained in this study.

- Walls without any intervention negatively affect people
- The design interventions to the wall surfaces reduce the negative effects caused
- Constructiveness, planting and both constructiveness and planting interventions on walls increase urban quality of life and landscaping quality
- The diversity of activities in the areas of the walls is effective in the choices of intervention (planting intervention for children's playgrounds and roadsides, construction intervention for sports areas and constructiveness–planting intervention for resting areas).
- The intensity of intervention to walls is effective when developing design proposals

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Data availability The datasets generated during and/or analysed during the current study are not publicly available due to [REASON(S) WHY DATA ARE NOT PUBLIC], but are available from the corresponding author on reasonable request.

Declarations

Conflict of interest The author declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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