

*Full Length Research Paper*

# The effect of window views' openness and naturalness on the perception of rooms' spaciousness and brightness: A visual preference study

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**This study examines the effects of window view on perception of spaciousness, brightness and ultimately, on room satisfaction in a campus building. Eighteen identically sized offices in the three-story Department of Landscape Architecture at Ankara University were chosen for this case study. Within a case study research design, the openness and naturalness characteristics of the window views were assessed by expert reviewers as well as room occupants. Eighteen single-room occupants were interviewed to assess their perceptions of spaciousness, room brightness and satisfaction with rooms and window views. As predicted, the rooms on the upper floor were perceived larger due to expanded open window views, and lower floor rooms were perceived darker. During winter, users in rooms with open and natural window views perceived their rooms larger. Findings revealed that occupants in offices that have more open and natural views rate their room satisfaction more highly. The aim of this investigation is to contribute to the knowledge base needed to design more effective offices and to establish a basis for further research in this area.**

**Key words:** Window view, user satisfaction, natural environment, office space.

## INTRODUCTION

### Natural versus built environments

Research has generated a relatively rich literature to explain the ways in which natural and built environments have an effect on human health and well-being. Urban environments were found to lack the beneficial restorative properties of nature. On the other hand, viewing natural scenes contributes to reducing stress and promotes more positive feelings (Ulrich, 1981, 1984; Ulrich et al., 1991; Verderber, 1986; O'Connor and Davidson, 1991; Heerwagen, 1990; Devlin and Arneill, 2003; Beauchemin and Hays, 1996). A view of vegetation through a window, produces positive psychological effects, and the presence of windows appears to increase healing (Pitt and Zube, 1987; Ulrich et al., 1991; Butchart et al., 2006). A substantial amount of evidence indicates that natural

environments are evaluated more favorably and preferred over built environments (Balling and Falk, 1982; Butler and Stuerwald, 1991; Kaplan, 1993; Kaplan, 2007), and that natural environments have more restorative potential than built environments (Kaplan, 1995; Herzog, 1992; Cackowski and Nasar, 2003; Karmanov and Hamel, 2008). Tennessen and Cimprich (1995) found that university dormitory residents with more natural views from their windows had better performance on attentional measures than those with less natural views. Findings of literature on environmental preferences for emotional healing suggest that particular features of gardens such as greenery were particularly helpful in increasing user satisfaction (Ulrich, 1984; Cooper-Marcus, 1995; Cooper-Marcus and Barnes, 1999; Whitehouse et al., 2001).

The findings above show that the subjects' psychophysical states change in different ways as a function of the type of environment; exposure to nature categories has more beneficial influences on the psychophysical

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states. Most of these studies assessed the restorative effects of natural versus built environments; however, there is a lack of empirical research focusing on the relationship between the characteristics of the window view and occupants' perception of room space. Although the results of previous research indicate the positive health effects of natural views, no clear relationship was identified between view openness and naturalness, and satisfaction.

### Window effects in office environments

Research in office environments supports the positive effects of natural window views on job satisfaction and environmental preferences; people express strong preferences for access to windows in offices (Leather, Pyrgas, Beale and Lawrence, 1998; Brill et al., 1984; Verderber, 1986; Dogrusoy and Tureyen, 2007). Office users preferred rooms with windows (Hedge, 1982; Verderber, 1986) and most of workers preferred seating locations next to the windows (Wotten and Barkow, 1983). Windows are important because they provide a link to the outside. Through windows, users can see what time of day it is, observe changes in weather, as well as simply enjoy the views. Better comfort ratings are generally received from office occupants with access to windows than from those seated away from windows (Vischer, 1996; Stone, 1998). Likewise, windowless offices have negative effects on job satisfaction (Heerwagen and Orians, 1986; Nagy, Yasunaga and Kose, 1995).

Working in the office environment with a glass window that looked out on a nature scene was more restorative than working in the same office without the outside view (the blank wall condition) (Kahn et al., 2008). Keighley (1973 a, b) found that windows occupying 10% or less of the window wall were regarded as extremely unsatisfactory; satisfaction was greater for a window occupying 20% or more of the wall and larger windows were evaluated as most satisfactory. In summary, of all the benefits and psychological functions provided by windows, the provision of a view appears to be most valued by building occupants. A significant part of the satisfaction derived from nature does not require being in the natural setting, but rather having a view of it (Kaplan, 1992). Taken together, the results indicate that windows should occupy at least 20 - 30% of the window wall, and, consistent with the previous research on view, what can be seen from the window is of great importance in determining a person's satisfaction with a room.

The major problem with previous studies is the assumption that the presence of windows is the variable of interest; they do not take into account what could be seen from the window. Research conducted in hospitals (Ulrich, 1984) and other settings (Kaplan, 1993) indicates that a window view of another building has no effect on

individual well-being and is similar to having no window at all. Kaplan (1993) found that what could be seen from the window is more important than just having a window. She found that a view with only "built" elements did not foster any psychological benefits, although a view with even a few elements of nature made large differences in worker ratings of satisfaction with their job, life and overall health. With respect to participants who had similar (desk) jobs but different access to nature in their view, those with a view reported significantly fewer physical ailments and greater job satisfaction compared to those workers without a view.

### Lighting quality in office environments

Designers are interested in the effects of daylight and its control on satisfaction in office environments (Boubekri et al., 1991; Knez and Kers, 2000; Leather et al., 1998; Nagy et al., 1995; Reinhart, 2002), and previous research indicates that lighting is important to the overall quality of the workspace (Verderber and Reuman, 1987; Brill et al., 1984; Marans and Yan, 1989; Galasiu and Veitch, 2006). Window sizes, position of the windows and window view, which affect room brightness, have been studied for their effects on mood and well-being of office workers (Biner et al., 1993; Boubekri et al., 1991; Butler and Biner, 1989; Butler and Stuerwald, 1991; Finnegan and Solomon, 1981; Heerwagen and Orians, 1986; Heerwagen, 1990; Knez, 1995; Leather et al., 1998; Yildirim et al., 2007; Kaplan, 2007). Researchers have overwhelmingly concluded that offices with larger windows have positive impacts on user satisfaction due to the expanded views and increased penetration of natural light (Keighley, 1973 a, b; Boubekri et al., 1991; Leather et al., 1998). However, there can be no guarantee that natural light will always be successful in maximizing satisfaction; daylight can cause visual discomfort through glare and distraction, and it can diminish the stimuli and task presents to the visual system (Veitch et al., 2005). People will take action to reduce or eliminate daylight if it causes discomfort or increases task difficulty (Kibert, 2005).

The main purpose of office lighting is to provide a comfortable and an efficient working environment; the presence of visual and psychological comfort conditions ensures user well-being and increases motivation that will lead to a higher performance and improved productivity (Manav and Yener, 1999; Manav, 2007; Odemis et al., 2004). With properly installed and maintained daylighting systems, natural lighting has proved to be beneficial for health, productivity, and safety of building occupants (Abdou, 1997; Finnegan and Solomon, 1981). These studies mainly concluded that the pleasant environment created by natural light decreases stress levels of office workers. However, these studies only used the artificial lighting for assessing the effects of illuminance on human comfort and the window factor was omitted.

## Light measurements

People use luminance distribution as a basis for judgments about the appearance of a space (Veitch, 2001). Light measurement in an experimental setting is a relatively recent phenomenon, and most lighting measurements were made by a stand-alone light meter; which is known for its precision and reliability (Higgins et al., 2007; Durak et al., 2007; Tiller and Veitch, 1995; Manav, 2007). These measurements were made in rooms with mostly fixed or manipulated lighting conditions; lighting measurements in real settings where environmental factors, such as sun penetration and sun exposure, change, is a major problem for the researcher (Higgins et al., 2007). During the experimental procedures, the room lighting can be controlled by the experiment; however, it is not realistic to control lighting levels in real office environments. It will be more reliable, therefore, to generate systematic techniques to measure instant illuminance levels in offices.

## Perception of room spaciousness

Perception of room spaciousness, which is influenced by the physical properties of environments (Stamps, 2007) has effects on user satisfaction (O'Neill, 1994; Stamps, 2005; Stamps and Smith, 2002). Herzog (1992) defined spaciousness as "the feeling of openness or room to wander" (p. 238). According to this definition, spaciousness is a subjective rather than a physical variable. Coeterier (1996) correlated spaciousness to the physical characteristics of the environment. According to Coeterier (1994), perception of spaciousness is enhanced by the integration of physical cues such as the size and form of open space, the height of the elements in the landscape, the texture of the ground and other surfaces, and the arrangement and positions of surfaces. A space may be perceived as larger because of transparent surfaces such as screens and windows. The high level of space complexity is another factor that affects spatial perception (Hidayetoglu et al., 2010); complex spaces are perceived darker and confined.

Lighting level was found to be related to the perceived spaciousness; variances in judgments of spaciousness were attributed to amount of light (Kirschbaum and Tonello, 1997; Inu and Miyata, 1973; Martylink, 1973; Oldham and Fried, 1987; Oldham and Rotchford, 1991). According to the research findings, a larger room was perceived more positively than the smaller room (Bharucha-Reid and Kiak, 1982) and adjusting the ambient level of light can make a room larger or smaller (Stamps, 2007). Sutherin (2005) found that students' perceptions of lighting levels in a dining facility had an effect on how they perceived the space; bright spaces were perceived as more spacious. Room location, either being on the upper or lower floor, is related to perceived

spaciousness; rooms on upper floors of a building might look more spacious due to the expanded view (Kaya and Erkip, 2001). Schiffenbauer et al. (1977) indicated that many of the occupants in dormitory buildings wanted to move out of their current room to the one on a higher floor in which rooms might look and feel more spacious due to the expanded view. In her experimental procedure, Manav (2007) concluded that an increase in the illumination level improved comfort and feeling of spaciousness. Durak et al. (2007) explored that different lighting arrangements and different illuminances affected the perception of the same space; different lighting levels could be used to enhance spaciousness, relaxation, pleasantness and order of a room.

All these findings suggest that perceived spaciousness changes according to room location and lighting conditions. Other factors such as furnishing (Miwa and Hanyu, 2006; Gifford, 1988), type of office plans (open plan or private) (Yildirim et al., 2007; Sundstrom et al., 1982; Veitch et al., 2005), poster displays on walls (Kweon et al., 2008) and social density (Kaya and Erkip, 2001) are mostly influential on interpersonal communication and social behaviors; individual perceptions of room features such as feeling of spaciousness and brightness have not been studied or tested in these settings. This study highlights the effects of aesthetic conditions in office environments, especially lighting conditions and window-views. Besides these factors, there may be several other physical issues that may affect users' perceptions of their rooms. However, these possible relationships between physical conditions and room satisfaction and perception were beyond the scope of this study.

## PURPOSE AND HYPOTHESES

This study examines how window view openness and naturalness is related to users' (1) room satisfaction, (2) perceived spaciousness, (3) perceived room brightness and (4) window view satisfaction. These perceptions are important aspects of user satisfaction or lack of satisfaction with an office. To demonstrate these relationships, the following hypotheses are tested:

H1. Characteristics of window view (naturalness and openness) are related to perceived room spaciousness. Occupants of rooms with natural and open window views will generally perceive their rooms as more spacious.

H2. Openness of window view is related to perceived room brightness. Rooms on upper floors have more open window views, and therefore occupants on these floors perceive their rooms as brighter.

H3. Perceived spaciousness is related to user satisfaction; therefore occupants who perceive their rooms as larger, which are more apparent in rooms with more open and natural window views, are more satisfied with their

rooms.

H4. Naturalness of window views is related to window view satisfaction. Occupants of rooms with natural window view will generally satisfy with those views.

The direction of these hypotheses is clear, based on the literature; however, neither of the extant literature nor any theories provide a strong basis for making predictions as to the direction of the relationship between perceived spaciousness, room satisfaction and window view characteristics, such as naturalness and openness.

## METHODOLOGY

### Setting

The study was conducted in the Department of Landscape Architecture in Faculty of Agriculture Main (South) Campus during the months of June and November, when different seasonal effects could be observed. This realistic environment ensures that any findings will be ecologically valid. Another reason this type of setting is ideal for this particular study is that these settings provide laboratories in which many environmental characteristics have been manipulated by designers such as location and window view. This was not an experimental setting in which the researcher had the ability to manipulate variables, so it was vital to select similar rooms in the building. There are 18 single rooms in the building with three floors and all of these rooms were selected for data collection (Figure 1). All rooms, with only one occupant in each, have identical lengths and widths (5.5 × 2.5 m), and window sizes (1.2 × 2.2 m). All rooms have vertical windows that admit the most variable and dynamic view from ground to sky.

These similar rooms, on the other hand, have different interior design features such as furnishing, display on walls and the presence of plants. It is the intention of this study, however, to focus on the effects of window-view characteristics on users' perception of room characteristics. In order to validate results, two separate measurements and data collection sessions were employed.

There are 11 east-facing and 7 west-facing single rooms in the building and their locations are quite different with different views and visual expanses from their windows. In order to assess the characteristics of rooms and window views, all rooms and window views were photographed with a digital camera to record environmental characteristics. The pictures were assessed based on the rooms' location in the building and view characteristics.

### Defining openness and naturalness of window views

Openness and naturalness of window views were assessed by selected experts-landscape architects. Twelve experts rated the pictures of window views taken from the eye level while standing inside the rooms. Expert reviewers scored the naturalness and openness of the window views on a 5-point scale (1 = open / natural, 5 = closed / built). Assessments of views were based on characteristics such as: view of a parking lot, another building or a green space, and presence and characteristics of vegetation (type of tree and shrubs, height of trees), season and time of day.

The professional orientation of the sample could constitute a significant source of bias; for reliability purposes, randomly selected pictures were shown to 15 freshman students who were not informed about the origin of pictures. Students rated the pictures according to the naturalness and openness scales. Expert ratings

were compared with the ratings of the pilot group; both groups arrived at the similar conclusions regarding the openness and naturalness of each view.

### Interviews

In order to assess user perceptions of room conditions and window views, interviews with room occupants were conducted in each office. During interviews, the aim and the procedure of the study was briefly explained. The questionnaire asked how occupants perceive their window view: Whether they are satisfied or not with the window view and with the rooms in general and how these views affect their room satisfaction, how they perceived room spaciousness and brightness. These responses were recorded on 5-point scales (1 = spacious / dim, 5 = confined / bright).

### Lighting measurements

Outside weather conditions and light intensity were impossible to control or manipulate during each field sessions. It was obvious that these conditions might change during the interviews. For reliability purposes, interviews and picture taking took place during noon hours and only in open weather conditions when there was no precipitation. A hand-held illuminance meter was used to measure the light intensity on the work surface of the desk before and after each interview session; none of the measurements were affected by the direct sunlight. Average values of the light measurements were obtained and used for statistical analyses.

## RESULTS

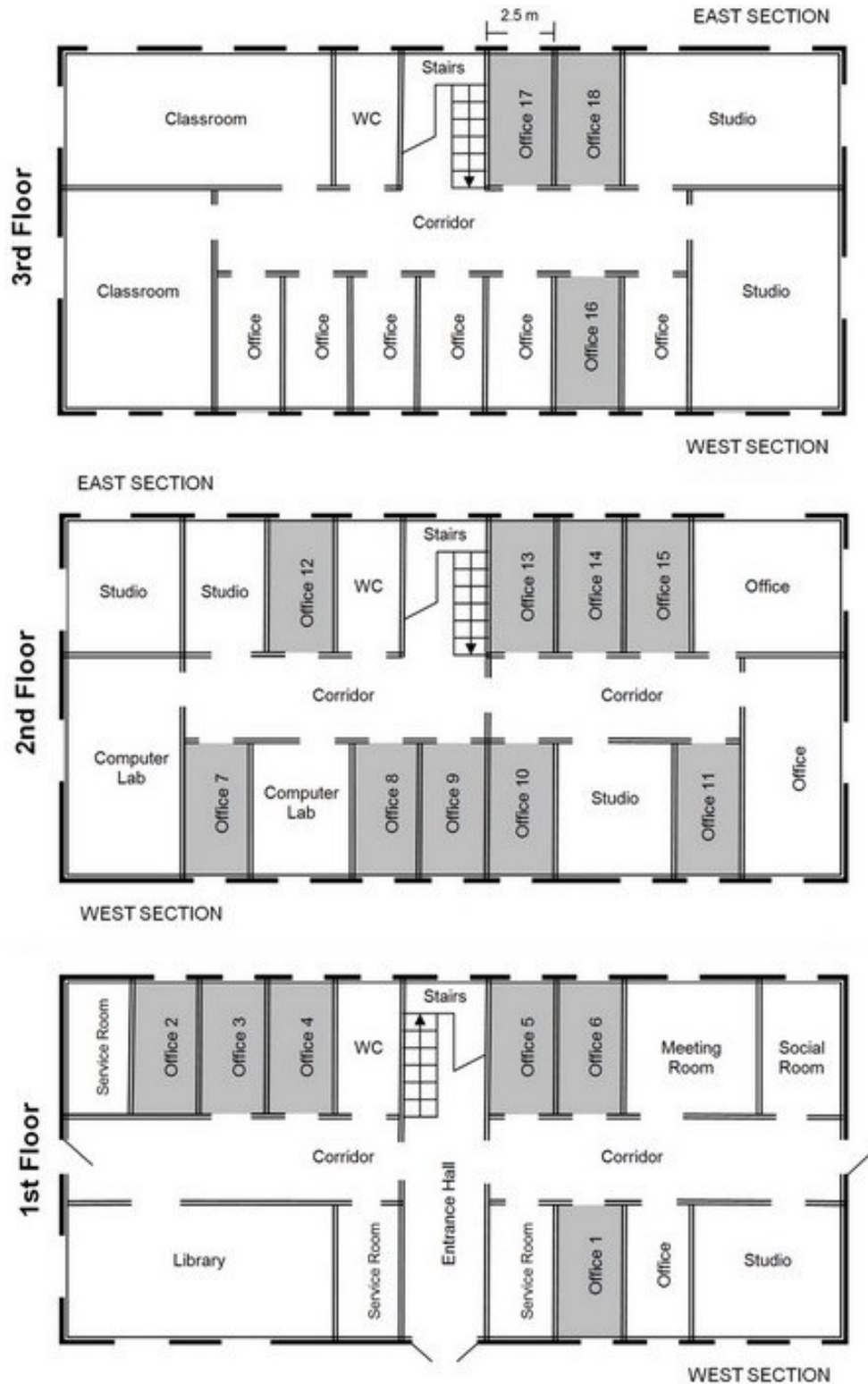
The aim of this study was to find out whether scores derived from user surveys correlated with expert ratings. Variables were openness and naturalness ratings of window views, and ratings of room occupants for room spaciousness, brightness, room satisfaction and view satisfactions. These continuous variables were measured as cumulative points on self-report scales. Since all the variables are continuous, the correlation is the appropriate test of the hypotheses. Demographic data were displayed in percentages and mean scores of ratings were compared across floors and seasons.

### Sample characteristics

This study included faculty and staff of the Department of Landscape Architecture at Ankara University. Among 18 respondents, 11 are females and 7 are males. All of the respondents are above the age of 30 and 27% of them are above the age of 54. All respondents had been using in their particular offices for more than three years.

### Brightness of rooms

Figure 2 shows the lighting level distribution of rooms in different floors across seasons. The scatter-plot of the lighting distribution shows a variation among rooms in



**Figure 1.** Floor plans showing room layouts and window locations (selected rooms are shaded).

terms of lighting levels; some rooms became dimmer and others became brighter in summer. Most of the east-

facing rooms became dimmer during summer measurements, but all third floor rooms were brighter in summer.

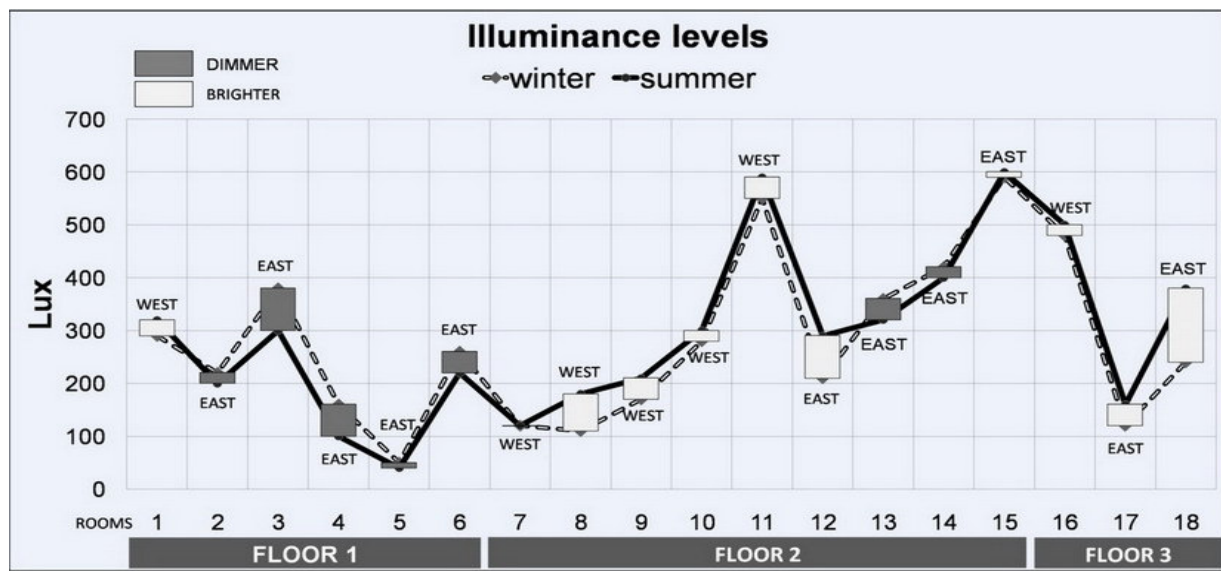


Figure 2. Scatter-plot diagram of mean lighting levels of rooms across floors in east and west locations.

This is mostly related to the openness and unblocked views on the upper floors, while first floor room views were blocked by vegetation in summer. Assessments of the lighting levels indicate that the brightness of rooms changed according to season, floor levels and direction of rooms. West-facing rooms on the third floor are the brightest in both seasons. As expected, east-facing rooms on the first floor are the dimmest in these seasons. East facing rooms on the first floor are brighter in winter than in summer (Figure 3). This is due to the summer blooming of trees that are adjacent to the east section of the building. Trees and large shrubs create shade during the summer months that limits the natural light.

### Window view openness and naturalness

Window view openness and naturalness were assessed by twelve experts on photographs. To determine the interrater reliability of the ratings, an interclass correlation coefficient for each room was calculated. Overall, the ratings of openness and naturalness performed by 12 experts were generally consistent and showed good agreement with each other. Interclass correlation (ICC) for the openness score was 0.98 ( $F = 2.29$ ;  $p < 0.05$ ) and naturalness score was 0.96 ( $F: 1.93$ ;  $p < 0.05$ ) indicating very high inter-rater reliability.

Figure 4 summarizes the openness and naturalness mean scores of window views across the three floors and the locations of the rooms. A one-way repeated measure ANOVA was carried out to determine whether the floor level and facing of rooms had any effect on the expert ratings. There was a statistically significant main effect of floor level on experts' ratings of openness ( $F(8, 24) =$

$2.97$ ,  $p = 0.018$ ). The mean openness rating on floor 1 was 3.75, on floor 2 was 2.17 and on floor 3 was 1.67. There was a statistically significant main effect of room facing ( $F(6, 11) = 5.236$ ,  $p = 0.0089$ ). The mean openness rating on west side was 2.5, and on east side was 2.68. However, there was no statistically significant main effect of floor level on experts' ratings of naturalness ( $F(8,24) = 0.95$ ,  $p = 0.496$ ). The mean naturalness rating on floor 1 was 1.92, on floor 2 were 3.06 and on floor 3 were 2.5. There was a statistically significant main effect of room facing ( $F(6,11) = 8.96$ ,  $p = 0.001$ ) on naturalness scores. The mean naturalness rating on west side was 3.71, and on east side was 1.86. These findings support the assumption that window view openness differs according to floor levels; with views on the upper floors are perceived and defined as more open than the views on the lower floors. Window views on the first floor were defined as more natural than views on other floors. As expected, east-facing rooms have more natural views than west-facing rooms, which have window views of buildings and walkways-the built environment.

### Perceived spaciousness across floors in two seasons

Figure 5 shows the mean ratings of spaciousness across floors in two seasons. Mean ratings of room spaciousness are same in both first and second floors. On the third floor, mean ratings of spaciousness increased in both seasons. It may be concluded that rooms in upper floors with open window views are perceived more spacious than the rooms in lower floors.

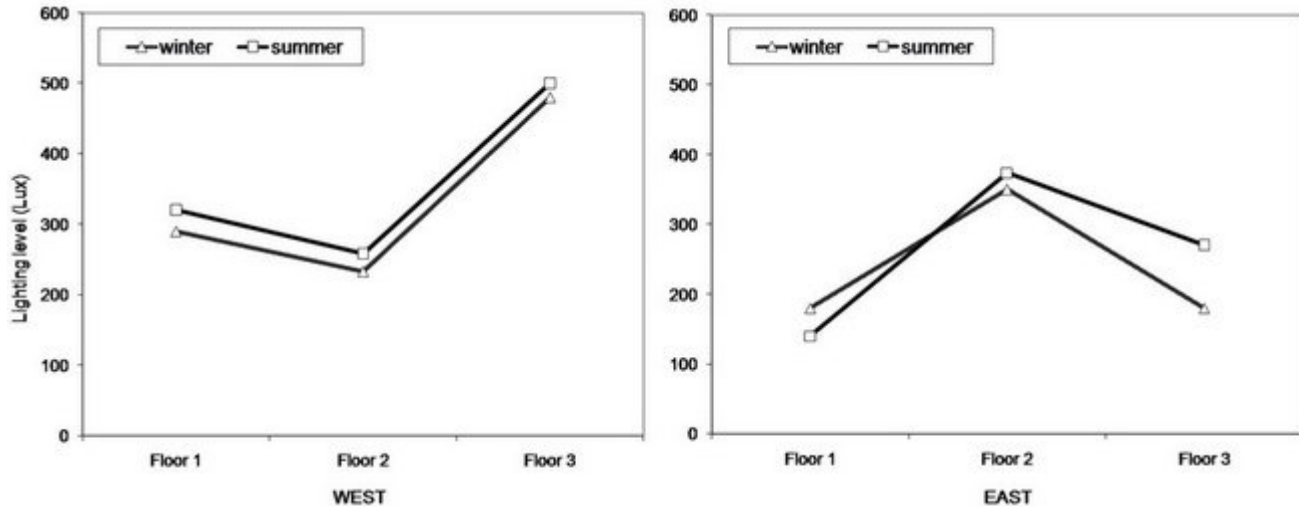


Figure 3. Lighting level distribution in all rooms during two seasons.

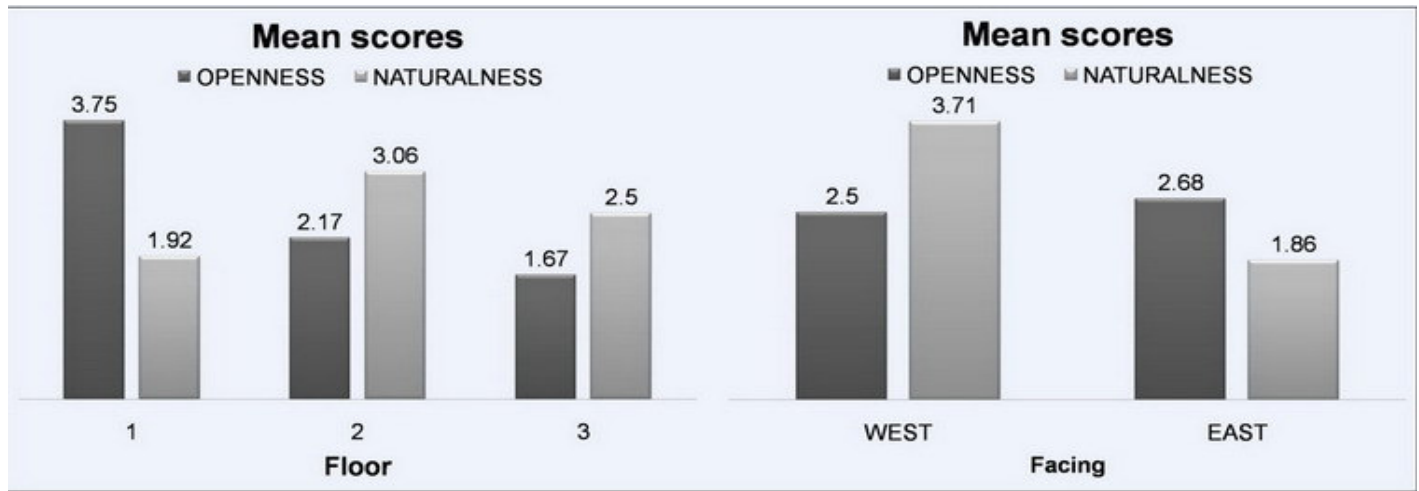


Figure 4. Mean scores of openness and naturalness ratings of window views across floors and room locations.

### Assessments of the relationships between variables

Table 1 displays the results of the correlation analyses to test the relationships between variables. Correlation tests revealed statistical significant relationships between openness and perceived spaciousness in winter ( $r = -0.46$ ,  $p < 0.05$ ). Openness of window view and perceived brightness are highly correlated in both winter ( $r = -0.75$ ,  $p < 0.05$ ) and summer ( $r = -0.72$ ,  $p < 0.05$ ). Openness of window view and room satisfaction are also related in both winter ( $r = 0.46$ ,  $p < 0.05$ ) and summer ( $r = 0.63$ ,  $p < 0.05$ ). Naturalness of window view and occupants' satisfaction with those views are correlated in both seasons ( $r = 0.51$ ,  $p < 0.05$  in winter and  $r = 0.52$ ,  $p < 0.05$  in summer). Only in winter, perceived brightness is correlated with perceived spaciousness ( $r = 0.46$ ,  $p <$

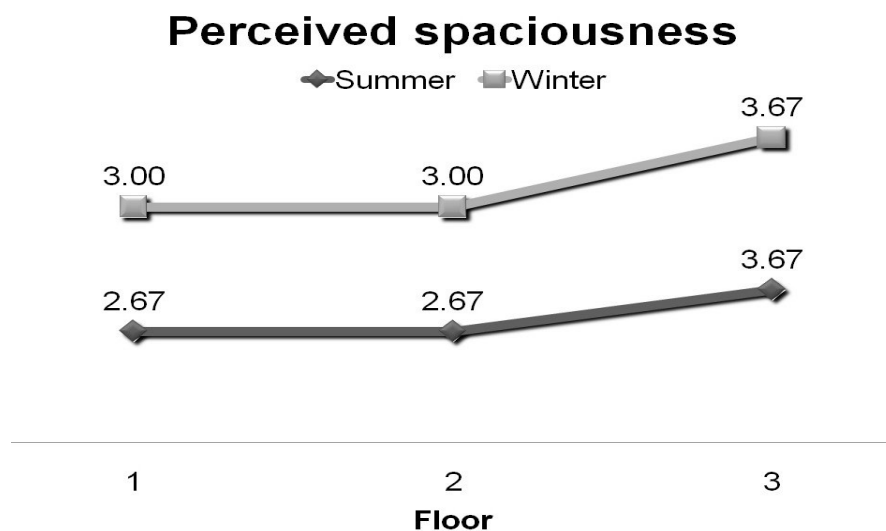
$0.05$ ). Perceived brightness is moderately ( $r = -0.62$  in winter and  $r = -0.58$  in summer) correlated with the room satisfaction ( $p < 0.05$ ).

Results indicate that users in offices with more open views are more satisfied with their rooms than users in offices with closed views. In rooms with open views, users perceive their room brighter. Users are also satisfied with the natural window views in both seasons. However, openness of window view is related to perceived spaciousness of rooms only in winter. This might be due to the blooming of trees, which may result in confined feeling during summer. Only, the openness characteristic of window views is related to users' perceptions of their rooms. Naturalness, on the other hand, has no relationships with both perceived spaciousness and room satisfaction. These results show that

**Table 1.** Relationship between window view characteristics (openness and naturalness) and user perceptions of spaciousness, brightness, room and view satisfaction (N = 18) (ANOVA).

Variable	Winter					Summer				
	Mean <sup>(1)</sup>	SD <sup>(2)</sup>	R <sup>(3)</sup>	Df <sup>(4)</sup>	P <sup>(5)</sup>	Mean <sup>(1)</sup>	SD <sup>(2)</sup>	R <sup>(3)</sup>	Df <sup>(4)</sup>	P <sup>(5)</sup>
H1 Openness	2.56	1.09	-0.46	15	<0.05	2.67	1.19	-0.38	15	0.12
H1 Perceived spaciousness	2.83	1.1				3.11	0.96			
H1 Naturalness	2.78	1.17	-0.31	15	0.22	2.39	1.14	-0.41	15	0.086
H1 Perceived spaciousness	2.83	1.1				3.11	0.96			
H2 Openness	2.56	1.09	-0.75	15	<0.05	2.67	1.19	-0.72	15	<0.05
H2 Perceived brightness	2.72	1.23				3.06	1.21			
H3 Openness	2.56	1.09	0.46	15	<0.05	2.67	1.19	0.63	15	<0.05
H3 Room satisfaction	2.67	0.97				2.72	0.89			
H3 Naturalness	2.78	1.17	0.14	15	0.58	2.39	1.14	0.05	15	0.83
H3 Room satisfaction	2.67	0.97				2.72	0.89			
Naturalness	2.77	1.17	0.51	15	<0.05	2.78	1.14	0.52	15	<0.05
View satisfaction	2.56	1.19				2.06	1.26			
H4 Perceived brightness	2.72	1.23	0.49	15	<0.05	3.06	1.21	0.45	15	0.062
H4 Perceived spaciousness	2.83	1.09				3.11	0.96			
H4 Perceived brightness	2.72	1.23	-0.62	15	<0.05	3.05	1.21	-0.58	15	<0.05
H4 Room satisfaction	2.67	0.97				2.72	0.89			

<sup>(1)</sup> Mean values of responses to Likert scale questions. <sup>(2)</sup> Standard deviations. <sup>(3)</sup> The correlation between the observed and predicted values of dependent variables. <sup>(4)</sup> Degrees of freedom associated with the sources of variance. <sup>(5)</sup> P-value for R (statistical significance if value <0.05).



**Figure 5.** Mean scores of perceived spaciousness ratings in each floor.

occupants' feeling of room spaciousness differs according to room brightness in winter. Office users are more satisfied with bright rooms.

To sum up, the findings of study:

1. Support hypothesis 1 partially (openness of window view is related to perceived spaciousness during winter).
2. Support hypothesis 2 (openness of window view is related to room brightness).



3. Support hypothesis 3 (openness of window view is related to room satisfaction)
4. Support hypothesis 4 (openness of window view is related to view satisfaction).

According to these results, relationships between openness and naturalness of window views are influenced by the season. There are differences in the perception of spaciousness, brightness, room and view satisfaction. These differences are due almost entirely to window view openness on the occupants' perception of room characteristics such as spaciousness and brightness.

## DISCUSSION

The findings of this research yield strong support for the effects of window view openness on the perception of spaciousness and room brightness. The results suggest that having an open window view affects room satisfaction and perception of spaciousness; a natural window view affects view satisfaction. Windows can play the role of bringing natural elements such as trees, and other vegetation into the indoor environment; as a result, a window view may stimulate positive mood and satisfaction. Even a single ornamental tree, which has various visual effects through seasons, may help satisfy room occupants. These factors indicate the importance of window view characteristics on occupants' satisfaction with their rooms and support the previous assumptions that; access to a window at work, having enough daylight, and an open view from the window is beneficial to office workers, affecting their perception of enclosed space. With more open window views, occupants will be more satisfied with their rooms; having natural scenery and open-distant views through windows will help occupants feel more relaxed during long office stays.

The results of this study are also consistent with a great deal of prior research that shows high preferences for natural views (Ulrich et al., 1991; Balling and Falk, 1982; Butler and Stuerwald, 1991; Kaplan, 1993; Kaplan, 2007). The findings of this study suggest that office room occupants highly prefer natural views. Rooms, which have identical sizes, were perceived as different sizes in different locations; some were perceived as larger and others confined due to the changes in variables such as brightness. In addition, users are more satisfied with bright rooms than darker rooms. Results revealed the effects of room brightness on perceived spaciousness in one season-winter; brighter rooms were perceived larger than darker rooms during this season. The building is located along the north-south direction, and higher rooms provide a more expanded view compared to rooms on the lower levels; rooms on the third floor were defined as larger and well-lit, which are positive aspects. Although the east side is assumed to receive more natural light

than the other side, that is not the case in this campus building; floor levels influence the brightness of rooms due to changes in the openness of the window views.

The hypothesis of expanded view that affects perceived spaciousness was also tested in this study by comparing users' judgments of rooms of identical size, with different locations and views. The findings support the assumption that window view openness differs according to the floor levels, and views on the upper floors are perceived and defined more open than the views on the lower floors. This result is relevant with and supports the findings of Schiffenbauer et al. (1977) and Kaya and Erkip's (2002) study. In addition, east-facing rooms have more open views than west side, which have window views blocked by the buildings. These characteristics affect the perception of spaciousness; rooms with more open window views are perceived as more spacious than rooms with more closed window views. As a result, spaciousness might be an influential factor for room satisfaction; users are more satisfied with rooms that they perceive spacious.

## CONCLUSIONS AND IMPLICATIONS

Previous studies indicate that offices differ in terms of satisfaction potential and that several physical characteristics of office environments are associated with satisfaction and perceived physical characteristics of offices such as spaciousness and brightness. The overall thrust of the research findings is that people prefer windowed rather than non-windowed places and windows, particularly windows with views of nature, are important in psychological and physical well-being. Natural window views may help office occupants to restore from stress, and result in a positive mood supportive for satisfaction. Windows provide daylight illumination, which generally is preferred over artificial light.

This study was conducted in rooms of identical size; all rooms were narrow with limited space for personal configuration. Almost all respondents expressed concerns regarding this limitation. Naturalness and openness of window views may be used to partly overcome this problem in buildings and settings with limited space. Designers can locate the buildings and rooms so that they face the natural and open views which will likely increase occupants' satisfaction with their rooms. Furthermore, the landscape features of the outside can be used to positively manipulate the perceptions of the office users. In previous studies, there were no explicit assessments of how a window view might influence user satisfaction. In addition, such studies were limited to office environments and dormitory buildings; educational facilities such as campus buildings have not been included in previous studies. This study explores the relationships of window views, perceived room

spaciousness and room brightness, and satisfaction with rooms in a field setting, in which occupants spend most of their working hours there.

Based on this study, it can be said that an integrated approach to design is essential in providing a comfortable atmosphere for office users. The approach contributes to the theoretical basis for landscape design beneficial to human health and satisfaction, and is a starting point for further research on the relationship between characteristics of the visual landscape and human well-being. From this study, openness of views emerged as the most important factor for room satisfaction. It would be best then to optimize window views to improve openness feeling and provide a spacious environment. In positioning windows and proper landscaping, the outdoors will enhance these perceptions. Buildings should be designed and positioned in such a way that those open and natural views through office windows will be at maximum levels.

The study is of theoretical interest, and its findings also have obvious practical implications for the optimal siting and orientation of buildings, new office designs, lighting quality of rooms and the utilization of existing buildings. It is expected that the results would contribute to the study of both social scientists and designers. This study proposed to provide architects, landscape architects, designers, facility planners and researchers with valuable information on occupant's perception of their office environments and adding to the body of research in environmental psychology. More research is needed in both experimental and field settings to investigate the effects of window view characteristics on various perceptions of office environments.

## LIMITATIONS

Some limitations of the study should be acknowledged. The study employed a small sample size and included respondents from one department building only, which makes generalizing the findings somewhat difficult. The study included self-reported perceptions of the window views and office environments, which might be problematic in terms of the reliability of measurements. Users' responses to interview questions would be influenced by several environmental and personal factors; elimination of those factors in a real setting is impossible during field study. Data collection took place only in two seasons; therefore future research should investigate users' reactions to research variables in other seasons.

Finally, this study highlighted the effects of aesthetic conditions in office environments, especially lighting conditions and window-views. Besides these factors, there may be more effective physical issues that may affect users' perceptions of their rooms. Further explorations of physical variables may stimulate or inhibit development of relationships between room characteristics,

and users' feelings of their rooms could be conducted by replicating or expanding existing studies of the environmental psychology in office environments.

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## Appendix

Samples of rooms and their window views with highest, moderate and lowest mean openness and naturalness scores.



Floor: 3 , East , Openness: 1.5 , Naturalness: 2.0



Floor: 2 , West , Openness: 2.4 , Naturalness: 3.8



Floor: 1 , East , Openness: 4.2 , Naturalness: 1.6