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## **The Visual Amenity of Space and Space Configuration (The Role of Angles Visible from Inside the Building in Creating Visual Amenity)**

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### **Abstract**

Buildings and cities have specific spatial properties that translate into social logical roles and imply the influence of each individual on another. Laleh Park Commercial Center is one of the side buildings of Tabriz city, located near the city center. Comparison of the spatial configuration characteristics of the places where the members of the groups lived. In the comparison of groups, based on the statistical analysis of the questionnaires, it was determined that the four groups studied had a significant difference in terms of satisfaction with the desirability of their workspace. Also, Group A salespeople work in spaces with very high depth (red - average depth map) and very low connectivity

(blue - average depth map). This was while Group C salespeople had good inward visibility (green - Isovist map) and their workplace had a high connectivity value (yellow - average depth map). Among the available indicators that can be examined, we select the average depth index to compare the locations of the members of the two groups. The average depth index indicates which categories of spaces are deeper than other spaces, which means that they are more difficult to access from a human behavior perspective. Figure (5) shows the average depth map of commercial spaces on the first floor and the location of Group A and C vendors.

**Keywords:** Commercial Buildings, Space Syntax, DepthMap, Tabriz, Space Suitability

### **1. Introduction**

The relationship between humans and the environment is a topic that has received increasing attention in academic circles in recent decades. The existence of a relationship between the natural and man-made environment and human mental health and subjective satisfaction with life has been proven in many studies and books (Stern, 2000) [68]. In addition to designing natural or quasi-natural components inside buildings and architectural spaces to maintain the connection of residents with the outside nature, architects restore the lost connection between humans and nature by creating openings in buildings (Phillips, 2004) [62]. People prefer rooms with natural light to rooms without windows unless the absence of natural light is necessary for a specific task (Harb *et al.*, 2015) [28].

The most reasonable way to use natural light is to use windows. However, in most cases, window design is based on purely aesthetic considerations, and less attention is paid to the issue of daylight efficiency and creating convenience for residents by considering their preferences (Sweller, 2004) [70]. The placement of appropriate openings with standard dimensions and sizes in appropriate places allows sufficient light to enter architectural spaces and provides a good view of the outside for residents. However, depending on the specific location of each building the external environment where it is located, and also the spatial configuration within the building, the perception of the residents of the connection with the external environment will be affected (Naghibi Iravani, S. *et al.*, 2024). This means that people's mentality will be affected by more complex conditions that common design standards may not be able to predict and take into account (Dizaji, A. A. 2024- a, b) [12, 13]. For example, consider a room that has standard dimensions, standard openings with appropriate dimensions and sizes, and a view of the external spaces through the windows. In terms of the design components that architects refer to, the room in question will have an acceptable design. If we consider this building to be a commercial building, we may find in interviews with salespeople who spend a lot of time doing their work in this room (Wood *et al.*, 2000) [73]. We encounter an interesting and thought-

provoking result. Despite access to windows, sufficient light, and a good view outside, salespeople may not express complete satisfaction with working in such a room (Iommi, 2016; Norouzian M. M., Talebian, M. H. 2023)<sup>[30, 56]</sup>. In this context, they complain about the lack of proper use of windows to provide a view outside and create openness and desirability of the space (Mohammad Mehdi Norouzian *et al.*, 2024)<sup>[51]</sup>. The main question that we seek to answer in this research is to what extent and how the configuration features of commercial spaces affect salespeople's satisfaction with the openness of store spaces (Gheitarani, N. *et al.*, 2024)<sup>[23]</sup>.

In other words, what is the moderating role of spatial configuration in the relationship between outward visibility and salesperson satisfaction? To answer this question, we must first explain the concepts related to spatial configuration as well as the factors related to salesperson satisfaction with working and being in indoor commercial spaces and visibility to outdoor spaces. The first hypothesis of the study is that people who have the most appropriate access to windows and the highest degree of visibility to the outside are expected to express the highest level of satisfaction with the pleasantness of the store environment. To examine this hypothesis, we will measure the level of satisfaction of employees located in specific points of the commercial building under study in the analysis of the collected data. The second hypothesis is that indicators related to spatial configuration affect salespersons' perception of the desirability of the space (MM Norouzian; N Gheitarani. 2025).

To examine this hypothesis, we also selected points on the first floor of the building under study. Several salespeople were located at these points. We will examine the relationship between the level of satisfaction of sellers and the characteristics of spatial configuration by measuring the qualities related to the configuration of spaces, to refute or prove the second hypothesis of this study. This article attempts to explore the role of the configuration of commercial spaces in this relationship, in addition to examining the relationship between the satisfaction of sellers and their visibility through windows (Naghbi Iravani, S., *et al.*, 2024). In fact, according to the questions and hypotheses of this study, the configuration of commercial spaces plays a moderating role in the relationship between satisfaction and the visibility of sellers, and we intend to examine the existence or absence of these relationships by selecting an appropriate sample (Norouzian, M. M., & Sarabi, M. S. 2023)<sup>[60]</sup>.

## 2. Theoretical

**Spatial Configuration.** To examine the role of spatial configuration in the relationship between visibility and seller satisfaction, we will first define the concept of spatial configuration. In this regard, we will introduce the concept of spatial configuration by reviewing the history of the formation of this concept, and the early theorists and founders of the concept of spatial configuration (Mahmoud Zahiri *et al.*, 2023)<sup>[43]</sup>. In 1984, Hiller and Hanson published the Social Logic of Space, a syntactic theory of spatial configuration in buildings and cities (Zaker Haghghi, K., *et al.*, 2014)<sup>[77]</sup>. In this framework, it is thought that the spatial configuration of living complexes or settlements provides a relatively accurate map of the economic, social, and ideological relations among its inhabitants (Koohsari *et al.*,

2016)<sup>[41]</sup>. The method of analyzing the configuration of spaces is called the syntax of space (Jiang & Claramunt, 2002<sup>[32]</sup>; MM Norouzian; N Gheitarani. 2023).

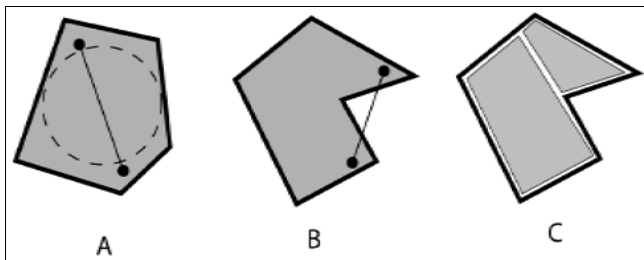
This method is a set of theories and methods that deal with spatial phenomenology (Abbaszadeh, M. *et al.*, 2015)<sup>[1]</sup>. Accordingly, urban designers and planners can predict the flow of movements before the actual development of architecture, and, by analyzing the morphological structure of the design program, they can predict it using spatial configuration techniques (Wu *et al.*, 2015)<sup>[74]</sup>. The spatial configuration method analyzes the relationship between all architectural spaces and presents the results as graphical mathematical parameters (Hoeven and Nes, 2014)<sup>[72]</sup>. The spatial configuration method helps to understand the consequences of changes in architectural spaces, especially the network of internal spaces, on the mentality and, consequently, the behavior of the occupants. For this purpose, using the spatial configuration method, how all existing building spaces are arranged one after the other (the sequential structure of spaces) is analyzed (Kahvand, M. *et al.*, 2015)<sup>[33]</sup>.

The arrangement method of such a form and combination of space identifies patterns that can be used to study architectural structures and human behavior (Omer and Kaplan, 2017)<sup>[61]</sup>. Spatial order, as the core of spatial analyses, is a concept that has emerged based on graph theories. In this method, spatial systems are analyzed not based on conventional geometric methods but on their spatial topology (Qurraie, Saba Sultan *et al.*, 2023)<sup>[63]</sup>. Space layout theory takes a new look at architecture and built spaces and practically deals with the concept of space as the main and new concept. Mathematical parameters can be used to create a model that predicts the performance and behavior in architectural spaces. Graphical data analysis of spatial configuration is a very effective tool in the process of architectural studies. In such a way that the impact of physical interventions in buildings can be seen graphically. The spatial configuration method is a method that has been very successful in predicting the movement of space users as well as the level of space use (Li *et al.*, 2017)<sup>[42]</sup>.

Therefore, this method can be a powerful analytical tool in the hands of researchers, especially in this research. One of the most important features of this method that we will rely on in this research is the ability to examine point and spatial indicators related to measuring space configuration. The application of the spatial configuration method in this article is that the researcher will analyze and measure the quality of spaces inside commercial buildings through this method. Through the results of the spatial configuration analysis, we will be able to evaluate the visibility of the sellers' internal spaces. Since this research aims to reveal the role and position of the configuration of spaces in the relationship between sellers' satisfaction and their visibility to the outside, the spatial configuration method will be efficient and fruitful. To analyze commercial spaces in the spatial configuration method, we must explain another concept called convex spaces because, in the spatial configuration method, we will only be able to simulate and analyze convex spaces (Aydin, A. C., *et al.*, 2020)<sup>[6]</sup>.

Convex spaces. Convex spaces are spaces where all points of that space are visible from any other point in that space, or in other words, a space where the line we draw between any two points of the space does not go outside (Gheitarani, N. *et al.*, 2013)<sup>[25]</sup>. In the figure below, A is a convex space

and B is a concave space, and in Figure C, the concave space has been transformed into two convex spaces (Gheitarany, N., *et al.*, 2013) [27].



**Fig 1:** Convex, concave space and conversion of concave space to convex

As stated, in the method of analyzing the configuration of interior spaces, we can only examine and evaluate convex spaces. However, the main method of analyzing and evaluating these spaces is the method that will be explained below (Ghadarjani, R. *et al.*, 2013). Analysis of convex spaces through the method of spatial syntax. It is an attempt to address the issue of how the state of spatial configuration expresses a social or cultural meaning (Sarabi, M. S., *et al.*, 2023) [67]. The purpose of spatial syntax is to describe how built places, such as buildings and urban street networks, are formed, especially how they are prioritized and connected. Therefore, spatial configuration is related to a logical process, because it must at least meet functional goals (Dizaji, A. A. *et al.*, 2023) [14].

In the spatial syntax approach, four indicators are used to examine the social characteristics of the samples (Niloufar Akbarzadeh *et al.*, 2016) [55]. These four indicators are connectivity, control, depth, and coherence (Jiang & Claramunt, 2002) [32]. In the following, we will introduce and define these four main indicators. Step-by-step depth. Step-by-step depth in convex spaces indicates the number of steps (changes of direction) that must be taken from a selected location to go to another location in convex spaces (Sarabi, M. S., *et al.*, 2023) [67]. While the selected location is step number 0 and all locations that can be seen by taking only one step are step number 1 and all other locations that must be reached by taking a certain number of steps are steps 2, 3, and so on (Marcus *et al.*, 2016 [46]; Gheitarani, N., *et al.*, 2024).

Observability through (Isovist). The specialized software for spatial syntax (Depthmap) can create closed polygons to calculate the potential viewability of these spaces relative to a given point in space by connecting these polygons (which correspond to the plan of built spaces and buildings) (Norouzian, M. M., & Gheitarani, N. 2023). These polygons, which are drawn approximately, are called Isovist (Yang *et al.*, 2015) [76].

**Salespeople's preferences for the desirability of commercial space.** In this study, we will examine the view out through windows and the view into interior spaces among the numerous factors that may affect the formation of a level of job satisfaction among salespeople. By reviewing

the literature on the desirability of commercial spaces, we find that desirability is created in two ways: Through the view to the outside through windows as the main openings and through the view to the interior spaces through the doors of rooms and corridors (Wymelenberg, & Inanici, 2014) [71]. Also, in this research, our main tool for measuring the view of the interior spaces will be the space syntax method and examining the configuration of interior spaces. Studies have been conducted in this field and we will examine the factors affecting the desirability of commercial spaces. One of the main design components that creates desirability in architectural spaces is the light that enters the building through openings (Saba Sultan Qurraie, 2024; Karimimansoob, V. *et al.*, 2024) [64, 35].

Windows are the most important openings for natural light to enter the building. Windows provides people with a view of the outside environment and also provides a way for natural light to enter (Zakerhaghighi, K., *et al.*, 2015) [78]. Several researchers have investigated people's preferences regarding the shape, size, number, location of walls, and degree of transparency of windows and the factors that enhance the desirability of indoor spaces (Konstantzos *et al.*, 2015). Some studies have also studied the window design process based on multi-criteria decision-making under various factors such as thermal behavior, ventilation, building form and orientation, and daylight factor (Chan *et al.*, 2015) [8]. Some studies have shown that visual issues precede thermal issues and that overall people's satisfaction is significantly affected by window area, and inversely proportional to the number and width of window sashes and frames (Konis, 2014) [38].

Konstantin *et al.* (2015) conducted a study in three commercial buildings in the UK to obtain minimum window sizes based on people's preferences (Konstantzos *et al.*, 2015). The study method was a controlled laboratory experiment in simulated rooms with real dimensions. In these rooms, in addition to the possibility of changing the dimensions of the room, the views and window dimensions were also varied. The results for a room measuring 3 x 5.5 x 7.3 m, windows with a width of 2.2 to 3.2 m, and a height of 1.5 to 2 m were obtained (Sadeghi *et al.*, 2016) [65]. In this study, the amount of indoor and outdoor light levels, as well as the position of the sun and the brightness (luminosity) of the sky, were not shown to be the main factors influencing the minimum acceptable window size selected (Samami, H., *et al.*, 2024).

Instead, it was found that the desired window width is directly proportional to the distance between the individual and the window, and the type of exterior view, the content of the view, and the angles of view to the outside are more important factors in determining this value, for example, closer views lead to the selection of wider windows than more distant views (Wymelenberg, & Inanici, 2014) [71]. Table (1) shows the factors and components that create subjective satisfaction of salespeople about the view outside and the performance of the window (MM Norouzian; N Gheitarani. 2025).

**Table 1:** Shows the factors and components that create subjective satisfaction of employees about the performance of the window and the view outside

Study and evaluation methods	Main research reviewed	Main priorities of employees	Influential factors	Factors
Experimental laboratory study	Zhang,2011 Roche. L, <i>et al</i> ,2001 Yildirim <i>et al</i> ,2007 Dogrusoy&Tureyen,2007 E.Ne’eman,R.G.Hopkinson,1970 brandi:2001 AL-Sallal,1998 KEIGHLEY,1973	Optimal window width between 3/4-2/8 m	Type of commercial space	of the types of desirable windows
Simulated rooms with real conditions	Sutter <i>et al</i> ,2001 Kapsis& <i>et al</i> ,2010 Foster&Oreszczyn,2001 Escuyer&Fontoynt,2001 Konis,2013 Newsham, <i>et al</i> ,2009 Inoue <i>et al</i> ,1988	Optimal window top height between 2/4-1/8 m	Type and content of the landscape	(Priority about

By reviewing Table (1), we find that factors such as natural light, natural ventilation, access to sunlight, creating space, visual connection to the outside, thermal comfort, and increasing motivation and patience were more effective than other components in determining people's preferences for windows (Hiring *et al.*, 2014). All three variables (width, floor height, and window height) depend more on the type of exterior view offered, with lower values for distant and ground-floor views and higher values for close-up and upper-floor views (Naghibi Irvani, S., *et al.*, 2024). Outside these ranges, there is a decrease in the level of satisfaction of residents with all types of views. Most sellers prefer to have a wide side view of the horizon and skyline. Another important factor in terms of visibility is the distance of people from the window and door. The further away people are from the window, the larger the window, and the closer they get to the window, the smaller it becomes (Chan, & Tzempelikos, 2012)<sup>[7]</sup>.

In a simulation study using computer software to determine the effects of the window factor on the amount and quality of indoor lighting, it was found that more horizontal windows bring more and more effective light into the interior space (Collins *et al.*, 2012)<sup>[9]</sup>. Also, a larger number of smaller windows than a single window with an area equal to the sum of their areas is more desirable and efficient (Xiong, & Tzempelikos, 2016)<sup>[75]</sup>. Also, the role of proximity to the entrance door to the rooms was determined to create a level of satisfaction in the minds of sellers (Suk *et al.*, 2013)<sup>[69]</sup>. After examining the factors related to the view outside through windows in commercial spaces, here we will discuss the role of interior spaces and the quality of the interior of buildings on the satisfaction of sellers. A field study in the Netherlands and Germany found that around 80% of salespeople would prefer to work in spaces that offer a view of the outside as well as a view of the inside of the building, despite artificial lighting (Duffy *et al.*, 2015)<sup>[16]</sup>.

Around 99% of salespeople surveyed in a study in the UK thought that offices should have windows to the outside, and 86% of them stated that natural light and good communication with other rooms were their top priorities for feeling satisfied (Allan *et al.*, 2014)<sup>[3]</sup>.

Similar studies have found similar results, indicating that salespeople believe that easy and convenient access to adjacent interior spaces with a view to the outside is better for psychological well-being, office appearance, overall health, visual comfort, and the color appearance of people and furniture (Duffy *et al.*, 2012)<sup>[19]</sup>. Of course, it should be noted that some components are effective in the formation of this mentality. For example, the current situation of the person about his/her location and other rooms affects his/her mental preference (Maleki, M., *et al.*, 2024)<sup>[45]</sup>. Salespeople who work in rooms with windows and whose rooms are connected to halls and indoor open spaces believe in these beliefs less strongly than those who work in rooms without windows (Duffy *et al.*, 2016)<sup>[17]</sup>. In a field study in Iran that included the opinions of 120 employees in 14 offices in Tabriz city, it was found that there is a strong correlation between the factor of satisfaction with light and the factors of workplace desirability and job satisfaction (Jadidian and Duffy, 2012)<sup>[31]</sup>.

Attitudes toward natural light and the playfulness of indoor spaces were more or less correlated with beliefs about the importance of lighting (illumination), the beneficial properties of bright light (brightness), beliefs about the harmful effects of fluorescent lighting (e.g., headaches and eye strain), and the effects of lighting on creating social environments (Duffy *et al.*, 2014)<sup>[18]</sup>. The researchers also noted that despite the high priority and satisfaction with natural light and the proximity of desks to windows, many respondents try to feel more satisfied with the space by keeping their doors open even when there is sufficient natural light (Duffy and Autin, 2013)<sup>[15]</sup>.

**Table 2:** Salespeople’s Attitudes Toward Indoor Space

Study and evaluation methods	Reviewed research	Main employee tendencies	Influential factors	Factors
Open and closed questionnaire	Baker&Steemers,2002 Newsham,2003 Barlow&Fiala,2007	-High preference for natural light over other lighting sources	-Type of business	-Beliefs about lighting types
Interview,	Galasiu&Veitch,2006 Velds,1999 Iwata <i>et al.</i> ,1994 Konis,2013	-Presence of windows in the office	-Existing physical conditions of the workplace	-Salespersons' estimates of the actual amount of natural light

By reviewing the existing theoretical literature on the subject of salespeople's perceptions of interior spaces, factors such as the way rooms are connected and the view of the building's interior spaces through internal openings such as the entrance door and partitions were identified as factors within the building that affect salespeople's satisfaction with the desirability of the space (Farrokhirad, E., & Gheitarani, N. 2024) [20]. After reviewing and extracting the factors effective in shaping salespeople's satisfaction with working in commercial spaces, to examine the hypotheses of this study and answer the main question stated in the introduction to this study, in the next section we will select a building as a study sample (Norouzian, M. M. *et al.*, 2024).

### 3. Methodology

The city studied in this thesis is Tabriz. This, given the high number of commercial buildings and their greater importance as the political and commercial capital of Iran, will be a suitable sample. The commercial building studied is a building related to Tabriz Municipality in District 5. The center of Tabriz and the Laleh Park Commercial Center are located in the Baghmisheh area of Tabriz. Tabriz City Center Tabriz is a 3-story building with a cruciform plan (Mehdi Norouzian, M., & Gheitarani, 2024) [47]. The main extension is east-west. It receives light from all directions. Most of the interior spaces are commercial open and closed plans. The windows are with plain glass and horizontal shutters. Most of the interior walls are made of wood or PVC coverings are brown and cream, and are mostly light (Khanian, M., *et al.*, 2019) [37].

The ceilings are made of gypsum and acoustic tiles in light colors (Norouzian, M. M. 2024). This building was recommended to the researchers by the Tabriz city authorities for environmental and field studies due to numerous lighting problems reported by the vendors. The building is exposed to light from both the north and south sides and a closed commercial plan system was observed on all floors (Figure 3), (Karimimansoob, V. *et al.*, 2024) [35].



**Fig 2:** Laleh Park Commercial Complex in District 5 of Tabriz Municipality in 2025

### 4. Research Method

The general method of conducting this research is quantitative. The type of data studied is also quantitative. The variables studied are the variable of satisfaction of sellers with the desirability of the workspace compared to the outside and inside of the commercial building, the variable of the quality of the view to the outside through the main openings, namely windows, and the variable of the desirability of the configuration of internal spaces (Dehghan, S. *et al.*, 2024) [11]. The tools for collecting and analyzing information include a questionnaire, SPSS software, and specialized software for spatial syntax, namely Depthmap software, version 2004. The mechanism for analyzing information is that first, through sampling, we select sellers who work in rooms with windows. From among these sellers, we select four main groups based on the criteria that will be stated in the sampling section, and we code each person in each group and question them to measure their satisfaction with the view to the outside and the desirability of their workspace (Arash Sohrabi, S. 2024-a, b) [4, 5].

In this study, we have two main goals. First, to find out whether the interviewee has a good view of the outside and inside. Second, what is the employee's suggested score for the overall desirability of the space where he constantly works? At the end of the interview, the results of the questionnaires will be entered into SPSS V.22 software for statistical analysis. Regarding the investigation of the specific spatial configuration method in the building under study in the Laleh Park complex in Tabriz, the first-floor plan of this building will be drawn in AutoCAD 2010 software and the output will be entered into Depthmap software. In Depthmap software, we will analyze closed polygons imported from AutoCAD software. Regarding the analyses in the space syntax section, four main indicators related to convex spaces will be analyzed (GHADARJANI, R., & GHEITARANI, N. 2013).

These four indicators are step-by-step depth index, observability, connectivity, and spatial coherence. It is important to note that to conduct joint questionnaires and spatial configuration analyses, specific points of the first-floor commercial plan of the Laleh Park Tabriz complex building must be selected so that sellers' satisfaction with the view outside and inside the building can be measured from that specific point. Through comparative and adaptive questionnaires and spatial syntax analyses, we will find out what possible impact the configuration of commercial interior spaces will have on sellers' perceptions of the friendliness of commercial spaces.

**Sampling:** The statistical population studied in this study is 62 sellers of the Laleh Park Tabriz commercial building, from which sellers whose permanent workplace and location was on the first floor of this building were selected. The reason for choosing the first floor was that we chose the first floor to minimize the impact of the connection of the configuration of other floors of the building. As Duffy suggests, in examining indicators related to building configuration, the floors that are examined below the floor may have significant effects on the level of these indicators through the connection points of these floors, namely the staircases (Duffy *et al.*, 2016) [17]. The second group includes salespeople whose desks are in a very good position concerning the view into the interior spaces of the building (the view to the outside of this group is normal),

(Group B). The third group includes salespeople who have a good view of the outside and the interior spaces (Group C). The fourth and final group includes salespeople whose desks are in a very poor position concerning the exterior spaces through the window and the interior spaces through the walls and other open spaces (Group D). It is important to note that the criteria for determining the proper view of the interior and exterior spaces were the spatial configuration map, Isovist analysis, and the distance from the window in the building plan (Khanian, M. *et al.*, 2013) [36].

**Questionnaire distribution and descriptive statistics:** A total of 16 questionnaires were distributed among the salespeople on the first floor of the Laleh Park complex building. Of the total number of questionnaires, 4 questionnaires were distributed equally among the members of each group. The respondents in Group A were located in rooms of units 1 and 2. Group B members were located in the revenue unit, Group C in business unit number 4, and Group D members were located in the secretariat and UPS rooms. As mentioned, the criteria for selecting the surveyed salespeople were spatial configuration indicators and distance from the window (Aghazadeh Dizaji, A. 2017) [2]. In the descriptive statistics section of this questionnaire, items such as gender, age, level of education, type of work, work experience, and predominant type of work were raised. Also, the characteristics of the workspace, type of glass, artificial light, proximity to the window, light and equipment, visual comfort, satisfaction, perspective on light, workplace lighting conditions, and lighting conditions of visual elements were asked.

**Comparison of groups based on statistical analysis of questionnaires.** As explained in the theoretical foundation's section, the principles, and criteria for creating commercial space desirability through the light entry and room dimensions And the details of the window construction.

Salespeople working in standard commercial spaces in terms of the presence of natural light and the distance of the desk from the windows are expected to express an acceptable level of satisfaction. Therefore, among the groups surveyed, members of Group A are expected to have expressed the highest level of satisfaction with working in the commercial space. It is also expected that respondents in Group D are expected to have expressed the lowest level of satisfaction with the desirability of the commercial space because they had a very inappropriate distance from the window.

Here, we will calculate and compare the satisfaction levels of all members of the four study groups through analysis of variance. A test used to compare the means of a quantitative trait in more than two populations is called analysis of variance (ANOVA) (Curtis *et al.*, 2015) [10]. One of the advantages of using analysis of variance (ANOVA) is that by conducting the test only once, the difference between the means of all groups in the experiment is examined (Zębala, & Kowalczyk, 2015) [79]. Given the same number of members in the groups and the same measurable characteristics, the analysis of variance (ANOVA) test was used to compare the satisfaction level of the sellers (Gheitarani, N. *et al.*, 2020) [24]. First, through a baseline study, 41 questionnaires were distributed among the sellers on the second and third floors of the commercial building of the Laleh Park complex in Tabriz, and by eliminating unstable questions, the final reliability of the questionnaire was calculated to be 0.79, which indicates the acceptable reliability of the questionnaire.

After distributing the questionnaires among the members of the four groups, Table (3) shows the details of the descriptive statistics of the collected questionnaires. The number of questions related to the descriptive statistics section was 12 questions.

**Table 3:** Shows the descriptive statistics of the questionnaires collected from the sellers on the first floor of the Laleh Park complex in Tabriz

Type of business				Education level			Number of reliable questionnaires		
Services and others	Expert	Employee	Manager	Associate's degree and below	Bachelor	Senior and above	Female	Male	Total
15	5	28	32	51	15	5	18	53	71

The number of questions in the analytical part of the questionnaire is 35 questions. In SPSS software, the one-way analysis of variance procedure poses the hypothesis of whether the mean of a quantitative variable is equal in different groups of the population. Since we compare a trait in several groups, we call it a one-way analysis of variance. In the case of salespeople in this study, the assumption is that the variances are equal in all four groups studied.

**Table 4:** The mean and standard deviation of the collected questionnaires

	N	Mean	St. Deviation	Minimum	Maximum
Group A	4	3.48	1.159	2	5
Group B	4	2.14	1.021	1	4
Group C	4	3.71	1.068	2	5
Group D	4	2.11	1.338	1	4

To examine whether the difference between the means of the groups is statistically significant, we examine the equality of variances between the four groups using the homogeneity of variances test. In this study, considering the value (Sig=0.061), the equality of variances is acceptable at

the alpha level of 0.05 (Table 5).

**Table 5:** Analysis of Variance (ANOVA) table

Groups	ANOVA				
	Sum of squares	df	Mean square	F	Sig.
Between groups	10.325	1.99	2.985	5.849	.005
Within groups	70.205	21.432	2.897		
Total	71.029	21.005			

According to the analysis of variance (ANOVA) table, the Sig. Value is equal to 0.02, which confirms the existence of a significant difference in the level of satisfaction with the desirability of the commercial workspace between the four groups studied. To ensure that this difference is significant between which combination of the two groups, we used the Tukey and Sheffe tests. The results of these two tests showed that groups A and C have a statistically significant difference in terms of the variable of satisfaction with the desirability of the commercial workspace. Below are the results of the Tukey and Sheffe tests for the groups with differences.

**Table 6:** Tukey and Scheffe tests to examine the significance of the difference between groups A and C

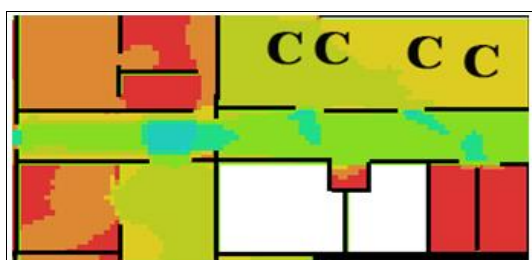
Multiple comparisons							
Dependent variable: Level of satisfaction							
	(I) L of Respondents	(J) L of Respondents	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	G A	G C	-0.398 *	.108	0.005	-0.68	-0.15
Scheffe	G A	G C	-0.398 *	.102	0.005	-.069	-.002

**5. Results**

As stated, according to the results of the statistical analysis presented in the previous section, the four groups studied have statistically significant differences in terms of satisfaction with the desirability of their workspace. This is while group C has the highest level of satisfaction with the desirability of their workspace and group D has the lowest level of satisfaction. The location of the members of Group A relative to the first-floor windows was better than that of the other respondents according to the standard, however, the members of Group C expressed greater satisfaction with the desirability of their workspace. To answer the question of whether the factors related to the configuration of internal spaces were influential enough to influence the perceptions of the members of group C in such a way that they expressed greater desirability than the members of group A, here we intend to compare the spatial configuration characteristics of the places where the members of groups A and C lived.

First, we determine the location of the members of the two groups A and C on the valued map of surfaces based on the visibility of indoor spaces (Isovist). It can be stated that the members of group A were located very close to the openings of commercial rooms 1 and 2. Also, their location is located in the blue part of the valuation map of visible interior spaces. Also, the members of group C, who were all working in commercial room 4, were located at a fairly appropriate distance from the windows of this room, while the Isovist value of their location was green. Also, through Tukey and Scheffe tests, two groups that had a significant difference were identified. Groups A and C were identified as having the most significant differences.

According to the theoretical criteria, the members of group A should have expressed the highest level of satisfaction. However, group C was the most satisfied salespeople with the desirability of their workspace. Next, we compared the visibility of the locations of the members of both groups to the differences in the values of the spatial configuration index of both groups. In this section, we intend to examine the reason for obtaining different (meaningful) results from what we expected according to the existing theoretical criteria. For this purpose, we once again use the spatial configuration indices in the locations of the salespeople of the two selected groups A and C.



**Fig 3:** Average Depth of First Floor Commercial Spaces and Locations of Salespeople in Groups A and C

In Figure (5), the red dots indicate spaces with very high average depths. Despite being close to the window, Group A salespeople were located in the red areas that have very high average depths. This means that the location of Group A members are located in a place that requires the most steps to reach, and the connection between these areas and other spaces on the first floor is very illegible and ambiguous. When Group A salespeople want to go to their desks, they enter the hallway through the staircase, which also has a relatively high average depth, and reach their rooms with a ninety-degree turn. These rooms have the least visibility to other spaces and work rooms, and the most changes of direction and steps must be taken to reach Commercial Rooms 1 and 2, where Group A salespeople are located. Of course, the desks and permanent locations of these salespeople are in a very good place to have a view outside, and the distance between their desks and the main windows of these rooms is only one meter.

However, the effect that the very high average depth of these rooms and the very low visibility of these two rooms prevent these salespeople from being the most satisfied salespeople in terms of the desirability of their workspace. On the other hand, the salespeople of group C in commercial room number 4 are affected by the medium and low depth. The color valuation of these parts is green, yellow, and orange, which indicates low depth and high coherence. As stated in the theoretical foundations section, the average depth and local coherence indices have an inverse relationship with each other, and this is also completely true in the color valuation of these two indices. Therefore, commercial room number 4 has more coherence than commercial room numbers 1 and 2. In other words, commercial room number 4 has a better view of the interior spaces of the first floor, and the salespeople working in this room can have a more dynamic relationship with other spaces on this floor and the salespeople living in them.

Therefore, although the members of group C have a smaller view of the outside through the windows of this room according to theoretical criteria and existing standards, their view of the interior spaces is more suitable than that of the salespeople in group A. The question that remains is how to statistically prove the relationship between salespeople's satisfaction with the desirability of space in all groups and a small number of indicators related to the spatial configuration on the first floor. For this purpose, in this section, we have presented the results of the correlation analysis between the questions that were related to the Mean Depth and Visibility of Spaces (Isovist) indicators out of the 28 questions in the analytical part of the questionnaire with the questions that were related to the overall satisfaction with the desirability of space. Table (7) shows the results of the correlation analysis between the spatial configuration questions and satisfaction with the desirability of the workspace.

**Table 7:** Results of correlation analysis between spatial configuration indicators and salesperson satisfaction

Correlations			
		Integration HH	Satisfaction
Integration HH	Pearson Correlation	1	0.747 **
	Sig. (2-tailed)		0.000
	N	4	4
Satisfaction	Pearson Correlation	0.747 **	1
	Sig. (2-tailed)	0.000	
	N	4	4

\*\* Correlation is significant at the 0.01 level (2-tailed)

As shown in Table (7), the correlation between spatial configuration indicators and salesperson satisfaction is significant (Sig=0.0001). This relationship is also direct and strong (R=0.747). Therefore, statistically, there is a significant positive and strong relationship between the satisfaction of salespersons on the first floor of the commercial building of Laleh Park Complex, Tabriz, and the characteristics related to the spatial configuration of this floor.

## 6. Findings

One of the main design components that creates desirability in architectural spaces is the light that enters the building through openings. Windows are the most important openings for natural light to enter the building. Windows provides people with a view of the outside environment and also provides a way for natural light to enter. The mindset of salespeople is that easy and convenient access to adjacent interior spaces along with a view to the outside is better for psychological comfort, the pleasant appearance of the office, overall health, visual comfort, and the color appearance of people and furniture. Of course, it should be noted that some components are effective in the formation of this mindset. For example, the current situation of the person about his location and other rooms affects his mental priority. In this study, an attempt was made to examine the role of spatial configuration in this relationship by examining the relationship between the view to the outside of commercial spaces through windows and the level of satisfaction of salespeople in these spaces.

For this purpose, the Laleh Park Complex building in Tabriz was selected as the study sample. Through a field study using a questionnaire, 16 salespeople who worked on the first floor of this building were selected. These 16 people were divided into four groups of 4 people. Groups named A, B, C, and D were identified. Through statistical analysis and a one-way variance test, it was determined that the four groups studied had a statistically significant difference in terms of satisfaction with the desirability of the workspace. It was also determined that the members of group C expressed the highest level of satisfaction with the desirability of the store environment. Groups A, B, and D were in the next positions, respectively. To determine which two groups had this significant difference, we used Tukey and Scheffe's Amons. By performing these tests, it was determined that groups A and C had a significant difference in terms of satisfaction with the desirability of the workspace.

According to the first hypothesis of this study, people who had the most appropriate access to windows and the highest level of visibility to the outside were expected to also express the highest level of satisfaction with the

convenience of the store environment. However, this was not consistent with the results of the analyses of this study, to the extent that members of group C, who had less access to windows to have the best view of the outside, expressed a higher level of satisfaction than members of group A, who had the most visibility to the outside.

## 7. Conclusion

Therefore, the first hypothesis of the study was rejected according to the results obtained. To investigate the reason for the significant difference in the results of the statistical test for groups A and C and what caused the higher level of satisfaction of group C members, we examined the spatial configuration characteristics of the first floor of the commercial building of Laleh Park Complex, Tabriz. For this purpose, we also examined the maps related to the visibility indices from inside (Isovist) and the mean depth (Mean depth) along with the location of the members of groups A and C. In this way, the second hypothesis of the study, which is that "indices related to spatial configuration affect the perception of sellers regarding the desirability of space", was also examined. Examining the configuration of the first floor spaces showed that group A sellers work in areas that have very little visibility inside (red color - Isovist map).

Therefore, the much higher quality of the spatial configuration indicators in the workplace of Group C members has enhanced their sense of satisfaction even more than that of Group A and other groups. The results of the correlation analysis presented in the previous section also confirmed the relationship between the spatial configuration indicators and salespeople's satisfaction. Therefore, the second hypothesis of the study was confirmed and it was found that the spatial configuration qualities affect salespeople's perception of the desirability and friendliness of the workspace.

Finally, it can be concluded that in addition to the role of windows in creating good outward visibility, the spatial configuration qualities also play a very decisive role in creating a sense of satisfaction in the minds of salespeople in commercial spaces. Therefore, it is recommended that designers and architects, when designing the interior spaces of buildings, consider the features related to the configuration of interior spaces and the view of interior spaces to enhance the desirability of the space and create a sense of spatial satisfaction, and present a design that meets the expectations of the space users.

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