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Research Article

The Effect of Wall Covering Form Used in Offices on Users' Perceptual Evaluations

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Abstract

Wall surfaces are the vertical planes that dominate the user's field of vision in interior spaces, and the form and colour tone of the materials applied to them are decisive in shaping spatial perception. Although the effects of colour on interior perception are well documented, the joint effect of covering geometry and wood colour tone in office environments, and the way this joint effect interacts with user demographics, remain insufficiently examined. This study investigates the effects of the geometric form (square/circular) and colour tone (light/dark) of wooden wall coverings used in offices on users' perceptual evaluations, together with the effects of gender, age, profession and work experience. Four photorealistic open-plan office scenarios (square-light, square-dark, circular-light, circular-dark) identical in every respect except covering form and colour were modelled in 3ds Max and presented to participants as 360-degree virtual space tours. A total of 219 volunteers evaluated the four environments on a seven-point semantic differential scale composed of 15 bipolar adjective pairs (Cronbach's alpha = 0.951). Data were analysed through one-way analysis of variance and Tukey HSD post-hoc tests. Colour tone produced significant differences in all 15 adjective pairs ($p < 0.001$): light-toned environments were perceived more positively than dark-toned ones throughout. The effect of form emerged independently in the affective dimensions, with the circular-light environment evaluated as the warmest and most intimate condition. Gender, age, profession and work experience all produced significant differences. The findings provide designers with an evidence-based guide for wall surface decisions in offices.

Keywords: Colour Tone, Form, Office, Spatial Perception, Wooden Wall Covering.

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INTRODUCTION

As Churchill (1943) expressed it, "we shape our buildings; thereafter they shape us" a remark that strikingly summarises the reciprocal interaction between people and space. The built environment does not merely leave a visual impression on the user; it also produces effects at mental, emotional and physical levels, and individuals develop strong responses to the spaces they inhabit (Roberson & Crumpton, 2022). Space stands at the centre of architectural research not only in its physical dimensions but also in its sociological, psychological and behavioural aspects. Lefebvre (1991) argues that space intersects with the production process of social relations and that architectural design and the built environment are directly connected to social, political, economic and ideological dynamics: while the individual transforms space, space simultaneously shapes the individual's perceptions and experiences. Kuban (2002) similarly maintains that architectural space should be defined not only through its formal properties but also through its qualities relating to human life, and that what renders space meaningful is the relationship its boundaries establish with the human being.

Individuals spend the greater part of their lives in architectural spaces such as dwellings, educational buildings, workplaces and healthcare facilities, and well-designed environments increase both the joy of living and productivity (Hasol, 2023). People spend approximately 87% of their daily time indoors (Klepeis et al., 2001), and in modern society this proportion reaches more than 70% of the lifespan (Kim & Rigdon, 1998). Among these indoor environments, offices occupy a particular position. Kroemer and Kroemer (2001) note that office employees spend roughly half of their waking hours in the office environment, which brings to the fore the necessity of designing these spaces in accordance with user comfort and highlights the effect of office arrangements on quality of life, employee productivity and institutional performance. Adults spend approximately one third of their lives, around 90,000 hours, at work (Harvard Division of Continuing Education, 2023). Although interest in remote working models has increased in recent years, open-plan office applications are still widely preferred in many institutions because of their flexibility and cost advantages. Research has demonstrated that the physical conditions of the workplace significantly affect employees' perceptions, attitudes and performance (Elsbach & Bechky, 2007). Erkan and Ozanözgü (2022) emphasise that office buildings are important spaces that should be evaluated in the context of their relationship with the user, and that spatial factors must be taken into account during the design process. Gerçek (2020) notes that workplace layout is frequently reported in the literature as being influential on variables such as status, belonging, organisational culture, productivity, job satisfaction and psychological well-being.

Vision is the dominant mode of perception in human beings and constitutes the basis of environmental perception (Rapoport, 1977). Understanding the relationship established with space requires examining how the individuals perceive that relationship. Visual perception plays a fundamental role in the individual's interpretation of environmental information; the fact that a large proportion of the signals transmitted to the central nervous system originate from the eye reveals the dominant effect of visual sensation on environmental perception (Lawson, 2001).

Wall surfaces used in interiors are among the most powerful carriers of these visual elements. Aydıntan (2016) argues that the majority of the visual messages intended to be conveyed in interiors are loaded onto vertical surfaces, and that these surfaces are regarded as "focal surfaces" because they attract user attention most strongly. Ching (2022) states that wall planes occupy a dominant

place in the user's field of vision owing to their vertical orientation and play a determining role in the enclosure and formal perception of space. Çomak (2020) notes that because walls are located at eye level, design decisions concerning them directly affect the user experience, and that a sense of meaning and identity regarding the space is conveyed to the user through the materials applied to their surfaces.

The covering materials preferred on wall surfaces are among the principal elements determining the perceptual quality of the surface. Aydıntan (2001) argues that in the selection of surface covering materials not only visual aesthetics but also the function of the space and the message to be conveyed should be taken into account. Soygeniş (2023) states that the texture of the wall element creates differences in spatial perception by reflecting the properties of the material used, and that stone, concrete, brick or wood coverings become important design components that strengthen perception by offering the user both visual and tactile experiences.

Form is defined by Onat (1995) as the formal order that emerges through the continuity of the boundaries determining the general shape of an object. Aytem (2005) states that form is one of the design components to which designers show the greatest sensitivity, owing to its three-dimensional character compared with the two-dimensional effects of colour and texture. The square possesses a hidden structural skeleton composed of central vertical, horizontal and diagonal axes, and within this skeleton it produces a sense of order, balance and discipline (Arnheim, 1974). The circle, having central symmetry from every direction, is the simplest form, described as the "primordial form"; having neither direction nor corner, it appears both as the child's first organised drawing and as a universal figure representing the universe and wholeness (Arnheim, 1974). Aydınlı (1986) states that rectangular forms create a balanced and dynamic effect, narrow-angled forms an unbalanced and disturbing effect, and circular forms a relaxing and restful effect. Arnheim (1974) likewise notes that when rotated about its centre the square is perceived as mobile and the circle as serene, summarising this phenomenon as "rotation for the square, rest for the circle".

Ateş and Özel (2023) state that colour changes made on the same form can transform perception. Alici and Paktaş (2020) note that warm and cool colours preferred particularly on walls affect the dimensional qualities of space such as width, height and airiness; warm colours make the space feel narrower, lower and closer, while cool colours produce a wider, higher and airier perception. Aytem (2005) emphasises that the designer must take into account how spatial effects will influence the individual in order to design spaces in which people can feel comfortable and at ease and which increase work productivity.

Various studies have demonstrated that wood used in office environments produces positive effects on users' psychological and physiological responses, reduces anxiety and stress levels, stabilises blood pressure and renders perceptions of the space more positive (Jiménez et al., 2016; Ojala et al., 2023; Sakuragawa et al., 2005). Zhu et al. (2023) determined that offices with light- and medium-toned wood were evaluated by users as aesthetically more positive than those with dark tones, and that spaces with lower wood coverage were preferred to those with higher coverage. Poirier et al. (2019) found that light-coloured and warm wood coverings, particularly oak, contributed to brighter, more relaxing and more productive environments in daylit interiors, the model covered with dark walnut was found to be darker and duller, with female participants in particular evaluating dark environments more negatively.

Another determining factor in spatial perception is the individual's demographic characteristics. Ertürk (1984) notes that even when individuals experience the same environmental conditions they may perceive that environment differently, and that these differences arise from characteristics such as age, gender, physical condition and level of expertise. Studies have shown that individuals with design education focus more on aesthetics and arrangements in the architectural environment and develop a more critical view towards environmental stimuli, whereas individuals without design education prioritise the functional and utilitarian dimensions of space (Coşgun et al., 2022; Ergün et al., 2023). Müezzinoğlu et al. (2020) determined that individuals without design education evaluated spaces dominated by chromatic colours more positively, while individuals with design education evaluated spaces designed with cool colours more positively. Gifford et al. (2002) and Yazdanfar et al. (2015) likewise report systematic differences between the environmental judgements of architects and laypersons. Gender differences in spatial perception have also been documented: some studies report that male participants evaluate environmental factors more positively, while others report that female participants perceive certain space types more positively (Coşgun et al., 2022; Yıldırım et al., 2007b). A concrete example of the effect of age difference on perception is seen in Hertzberger's design for an elderly care home in Amsterdam, reported by Rapoport (1990): the "perceptual unity" the architect sought to establish through a balance of white skeleton and black infill produced negative associations of "crosses and coffins" among the elderly residents, clearly demonstrating how differences in age and experience can transform design decisions. Stamps (1999), in a meta-analysis of demographic effects in environmental aesthetics, similarly concludes that demographic variables must be systematically taken into account in perception research.

The effect of form, colour, material and demographic characteristics on spatial perception has been documented in recent comprehensive studies. Yıldırım et al. (2021) revealed that in spaces using wall panels of different geometric forms, circular panels in particular were perceived by users as warmer, airier and more intimate. Coşgun et al. (2022) determined that light-coloured wooden wall coverings were perceived more positively than dark-coloured materials and that light-coloured wooden surfaces in particular added warmth to the space. Tutar and Yıldırım (2023) demonstrated that wall covering arrangements were influential on spatial perception in open-plan offices with three different covering layouts, while Güneş et al. (2019) determined that the colours used in offices were a decisive element in employees' perceptual quality and performance.

The international literature has likewise documented that variables such as colour, form and material proportion on interior wall surfaces play a determining role in user perception. Kwallek (1996), Kwallek et al. (1997) and Kwallek et al. (2005) revealed that office wall colour significantly affects the perception of spaciousness, employees' mood and work performance, and that light tones in particular make the space appear airier. Savavibool and Moorapun (2017) determined that neutral and cool colours in office spaces make the environment feel airier and more orderly, whereas warm and multicoloured environments are perceived as narrower and more complex. Ahmed et al. (2024) examined the effects of different wall colours (red and blue) on users' thermal comfort perception in a virtual reality environment and demonstrated that colour choice can directly affect spatial perception and comfort.

Another important development in spatial perception research in recent years is the use of virtual reality (VR) technology as an experimental tool. Mineev (2017) defines virtual reality as a real or simulated environment enabling the perceiver to

feel present through a medium of communication, and notes that this property makes it an effective tool particularly in research on spatial perception and user experience. Sherman and Craig (2003) state that virtual reality is an effective instrument in the architectural field, especially in architectural walkthroughs, design spaces and virtual prototyping applications, making the experience of architectural spaces possible at lower cost. Hidayetoğlu et al. (2012) state that virtual environments enable accurate results to be obtained at far lower cost than real environment scenarios, and emphasise that the literature clearly demonstrates the usability of virtual environments in scientific studies. Cha et al. (2020) examined the effects of four different colour schemes (red, green, blue and white) on users' emotional states, task performance and heart rates in an office-like virtual interior, and demonstrated that VR technology is an effective method for evaluating user responses and spatial perception. Banaei et al. (2017) and Banaei et al. (2020) reported that digital environments constitute an important alternative for users' experience and perception of space, while Ma et al. (2025) demonstrated the effectiveness of immersive virtual reality in end-user design review. Accordingly, VR technology offers a convenient, controlled and repeatable research environment for examining the perceptual effects of wall covering form and colour in offices.

These divergent findings in the literature indicate that spatial perception cannot be reduced to a single rule or formula. Ertürk (1984) emphasises with the statement that "there is no suitable cookbook for good architectural design" that the design process cannot be reduced to standard rules, and that each space must be approached in a manner that takes into account its own context and user characteristics.

Within this framework, although the effects of colour on interior perception have been examined extensively, studies that address the geometric form and colour tone of wooden wall coverings together in office environments, that measure this joint effect through 360-degree virtual space tours rather than static visual presentations, and that simultaneously analyse the moderating role of user demographics, remain limited. The present study is designed to address this gap.

Aim of the Research

The aim of this study is to reveal the effects of the geometric form (square/ circular) and colour tone (light/dark) variables of wooden wall coverings used in office spaces on users' spatial perception. Accordingly, four different virtual office environments were designed on the basis of two form and two colour variables; the spaces, modelled in a photorealistic environment, were presented to participants as 360-degree virtual space tours. Gibson (2015) notes that a picture or drawing offers limited visual information and cannot convey movement and depth in the way real visual perception does; for this reason, 360-degree virtual space tour technology was preferred as an effective instrument capable of conveying spatial experience realistically. Participants' perceptual evaluations were measured through a semantic differential scale containing 15 adjective pairs, and the effects of demographic variables such as age, gender, profession and work experience on spatial perception were also analysed.

Significance of the Research

Theoretically, the study contributes to the environmental perception and architectural psychology literature by supporting the spatial outcomes of form and colour variables with quantitative data. Methodologically, it offers an innovative experimental setup that goes beyond static visual presentations through 360-degree virtual space tours. Practically, it serves as a user-oriented

guide for interior architects, architects and office designers in wall surface design decisions.

Limitations

This study has certain limitations. The scope of the research is confined to the office environment; in the design of the wall coverings only the form and colour variables were addressed, and other variables such as texture and proportion were excluded. Although virtual environments provide a high degree of realism, they cannot fully simulate the multisensory experience (thermal, acoustic, olfactory and so on) of physical space.

Hypotheses of the Research

On the basis of the publications on spatial perception reviewed above, the research hypotheses formed in relation to the wall covering form and colour tone variables are as follows:

H1: Office spaces in which circular-form wooden wall coverings are used will be perceived and evaluated more positively by participants than spaces in which square-form coverings are used.
H2: Office spaces in which light-toned wooden wall coverings are used will be perceived and evaluated more positively by participants than spaces in which dark-toned coverings are used.
H3: Female participants will perceive and evaluate the physical environmental factors of offices using wooden wall coverings more negatively than male participants.
H4: There will be significant differences between participants' age groups in terms of the perceptual evaluation of office spaces using wooden wall coverings.
H5: Architect and engineer participants will perceive and evaluate the physical environmental factors of offices using wooden wall coverings more negatively than participants in other occupational groups.
H6: There will be significant differences between participants' lengths of work experience in terms of the perceptual evaluation of office spaces using wooden wall coverings.

MATERIAL AND METHOD

Research Model

In order to test the research hypotheses formulated in the introduction, a questionnaire was developed and administered to volunteer participants in an online environment; the general survey model was used as the research method. The study analysed participants' perceptual evaluations of wooden wall coverings with different geometric forms (square/circular) and colour tones (light/dark) used in office spaces.

Population and Sample

A total of 219 participants voluntarily took part in the research in an online environment. The sample size of participants selected to represent the research population was considered sufficient. Information regarding the gender, age, profession and work experience of the participants constituting the sample is presented in Table 1.

As seen in Table 1, 58.4% of the participants are female and 41.6% are male. In terms of age distribution, the largest group (46.6%) consists of participants aged 26–35, followed by the 18–25 age group with 27.9%, the 36–45 age group with 14.6% and the group aged 46 and over with 11.0%. According to the occupational distribution, 22.4% of the participants are architects, 22.8% are engineers and 54.8% belong to other occupational groups. According to the

distribution of work experience, 47.0% of the participants have 1–3 years of work experience, 14.2% have 4–6 years, 13.2% have 7–10 years, and 25.6% have 11 years or more of experience.

Data Collection Tools

In line with the aim of the study, a questionnaire was developed to determine the effect of the geometric form (square/circular) and colour tone (light/dark) variables of wooden wall coverings used in office spaces on users' perceptual evaluations. During the preparation of the questionnaire the literature in the fields of environmental perception and architectural psychology was reviewed in detail, and scales whose validity and reliability had been demonstrated in previous studies were taken as the basis.

Table 1. General information on the participants (produced by the authors).

Participant information		**n**	**%**
Gender	Female	128	58.4
	Male	91	41.6
Age	18–25	61	27.9
	26–35	102	46.6
	36–45	32	14.6
	46 and over	24	11.0
Profession	Architect	49	22.4
	Engineer	50	22.8
	Other	120	54.8
Work experience	1–3 years	103	47.0
	4–6 years	31	14.2
	7–10 years	29	13.2
	11 years and over	56	25.6

Note: n: Number of participants, %: Percentage value.

The questionnaire forms designed to test the research hypotheses consist of two main sections. The first section covers participants' general demographic information, and the second section contains questions evaluating the spatial quality of offices with different wall forms and colours. The design of the research questionnaire was based on a seven-step semantic differential scale composed of 15 bipolar adjective pairs ordered from 1 to 7 (1: positive, 7: negative), which was found valid and reliable in studies previously conducted by İmamoğlu (1975), Yıldırım (1999), Yıldırım et al. (2005), Yıldırım et al. (2007a), Yıldırım et al. (2007b), Yıldırım et al. (2007c), Akalın et al. (2009), Yıldırım et al. (2011), Yıldırım, Çağatay and Ayalp (2015a), Yıldırım, Çağatay and Hidayetoğlu (2015b) and Özkan and Yıldırım (2016). This scale comprises the adjective pairs beautiful/ugly, warm/cold, brightness/darkness, roomy/cramped, attractive/repulsive, airy/gloomy, high/low, intimate/formal, orderly/disorderly, well-planned/poorly planned, large/small, free/restricted, simple/complex, peaceful/disturbing and uncrowded/crowded.

In order to facilitate participants' understanding of the research questionnaire and to ensure the authenticity of the responses given, an explanatory and consent text was added at the beginning of the questionnaire, thereby securing responses only from volunteer participants interested in the subject. The questionnaire administration was supported by 360-degree virtual space tours so that participants could experience the environments more realistically. Participants navigated each virtual office scenario interactively and subsequently answered the questionnaire items. This method went beyond static visuals and offered a high level of realism and contextual evaluation. The questionnaires were completed in approximately 15 minutes using an online form created

through Google Forms during June 2025. The research data obtained from these questionnaires were subsequently analysed using the IBM SPSS Statistics software (version 22.0).

Research Environment

Virtual prototypes are increasingly preferred over their high-cost physical counterparts (Bayraktar & Kaleli, 2007). In this study, 360-degree virtual space tour technology was used in modelling offices with two different wall covering forms and two different colours as the experimental environment. Banaei et al. (2017, 2020) reported in their studies that digital environments can constitute an important alternative for users' experience and perception of space. The virtual environments of the offices in which the experiments were conducted were modelled by taking 360-degree renders with the 3ds Max programme. The four environments are also made openly accessible as interactive 360-degree tours so that the stimuli used in the study can be inspected and reused by other researchers (see the note under Figure 1). The offices modelled for this experimental study are square in plan with an area of 500 m². All physical properties of these spaces other than the wall covering form (square/circular) and colour (light/dark) were held constant. In order to measure the perceptual effect of the wall coverings arranged in two different forms in the office spaces, the light wood and dark wood colours whose Natural Colour System (NCS) and Red, Green, Blue (RGB) codes are given in Table 2 were used.

The four different virtual office spaces created using the colours given in Table 2 (square-light, square-dark, circular-light, circular-dark) are presented in Figure 1.

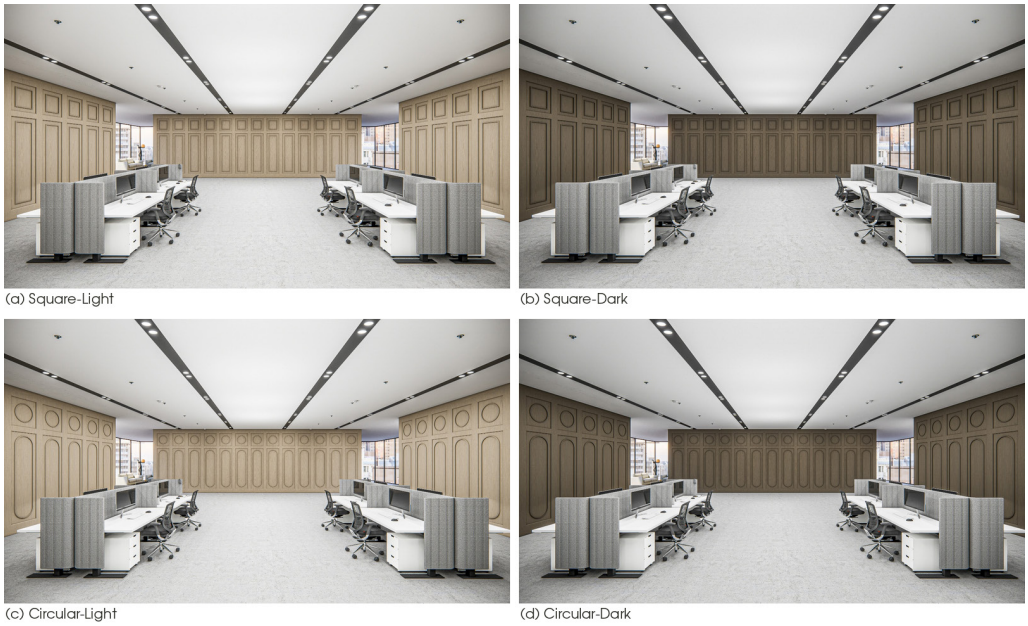
Table 2. Wood colours used in the virtual office spaces (produced by the authors).

Material colours	NCS and RGB colour codes	Image
Light wood	NCS: S 2020-Y40R — R: 205, G: 180, B: 145	
Dark wood	NCS: S 5015-Y50R — R: 115, G: 95, B: 75	

Note: NCS: Natural Colour System, RGB: Red, Green, Blue Colour System.

Analysis of the Data

In the research, participants' perceptual evaluations of office spaces with different wall covering conditions were defined as dependent variables, while the form (square/circular) and colour tone (light/dark) of the wall covering together with participants' differences in gender, age, profession and years of experience were defined as independent variables. First, Cronbach's alpha internal consistency analysis was conducted to assess the reliability of the questionnaire data. Subsequently, frequency, percentage, mean and standard deviation values were calculated within the scope of descriptive statistics. One-way analysis of variance (ANOVA) was applied to determine the differences between groups according to the dependent variables, and for variables showing significant differences the necessary post-hoc analyses (Tukey's honestly significant difference, HSD) were performed to determine at which levels the groups diverged. Mean values of the variables were reported through tables and figures.



(a) Square-Light (b) Square-Dark

(c) Circular-Light (d) Circular-Dark

Figure 1. Virtual office spaces with four different wall coverings (produced by the authors).

Note: The four scenarios are available as interactive 360-degree tours at the following addresses: https://cloud.chaos.com/collaboration/n/JgAq1pKNpoU1HB9tvoeTDG/present / Square-Light
https://cloud.chaos.com/collaboration/n/91AuLgqBaHwn6q1gS9sWfD/present / Square-Dark
https://cloud.chaos.com/collaboration/n/FiALj5toJaVpQLM11m5xxm/present / Circular-Light
https://cloud.chaos.com/collaboration/n/FaGPn9bWBU6c31SQGDeUGF/present / Circular-Dark

FINDINGS

This study investigated the differences between participants' perceptual evaluations of the physical environmental factors of different office scenarios created according to the geometric form (square/circular) and colour tone (light/dark) variables of the wooden wall coverings used in office spaces. In addition, it examined whether participants' gender, age, profession and work experience variables had an effect on the perceptual evaluations of office spaces in which wooden wall coverings were used. The findings that emerged as a result of the analyses are presented systematically below.

Reliability Analysis

First, Cronbach's alpha reliability analysis were conducted on the data concerning the dependent variables of the research, and the reliability values of the items and of the scale are given in Table 3.

Table 3. Results of the reliability analysis (produced by the authors).

Dependent variables	Item reliability	Scale reliability
Beautiful/Ugly	0.947	0.951
Warm/Cold	0.951	0.951
Brightness/Darkness	0.946	0.951
Roomy/Cramped	0.948	0.951
Attractive/Repulsive	0.949	0.951
Airy/Gloomy	0.950	0.951
High/Low	0.944	0.951
Intimate/Formal	0.947	0.951
Orderly/Disorderly	0.946	0.951
Well-planned/Poorly planned	0.947	0.951
Large/Small	0.945	0.951
Free/Restricted	0.948	0.951
Simple/Complex	0.949	0.951
Peaceful/Disturbing	0.950	0.951
Uncrowded/Crowded	0.947	0.951

As shown in Table 3, the reliability coefficient of the scale composed of 15 adjective pairs was determined as 0.951. Cronbach (1951) explained that alpha reliability coefficients may be accepted as reliable when they exceed the value of 0.70 for all items. The Cronbach's alpha coefficients of this study range between 0.944 and 0.951 for all items constituting the dependent variables, and these values are above 0.70. According to this result, the research data may be accepted as highly reliable.

Findings Related to Wooden Wall Covering Form and Colour Tone

The differences between participants' perceptual evaluations of the physical environmental factors of office spaces using wooden wall coverings arranged in four different configurations (square-light, square-dark, circular-light, circular-dark) were tested; the mean and standard deviation values of the results obtained, together with Tukey HSD homogeneity groups and ANOVA test results, are given in Table 4.

Table 4. Results relating to participants' evaluations according to wooden wall covering form and colour tone (produced by the authors).

Dependent variables	Square-Light	Square-Dark	Circular-Light	Circular-Dark	F	df	Sig.
Beautiful/Ugly	3.01 (1.57) A	3.61 (1.75) B	2.74 (1.58) A	3.70 (1.80) B	16.876	3	0.000*
Warm/Cold	3.51 (1.69) B	4.04 (1.69) C	3.05 (1.66) A	3.96 (1.65) C	16.214	3	0.000*
Brightness/Darkness	2.84 (1.55) A	3.95 (1.70) B	2.57 (1.45) A	4.02 (1.66) B	48.227	3	0.000*
Roomy/Cramped	2.80 (1.54) A	3.56 (1.64) B	2.67 (1.51) A	3.69 (1.56) B	24.179	3	0.000*
Attractive/Repulsive	3.26 (1.60) A	3.78 (1.65) B	3.00 (1.68) A	3.88 (1.68) B	14.011	3	0.000*
Airy/Gloomy	3.25 (1.70) A	3.98 (1.63) B	2.93 (1.65) A	3.98 (1.66) B	22.258	3	0.000*
High/Low	2.85 (1.44) A	3.49 (1.63) B	2.74 (1.50) A	3.50 (1.61) B	15.019	3	0.000*
Intimate/Formal	3.83 (1.80) B	4.58 (1.84) C	3.02 (1.77) A	4.20 (1.62) BC	31.706	3	0.000*
Orderly/Disorderly	2.42 (1.48) A	3.07 (1.57) B	2.59 (1.38) A	3.14 (1.55) B	12.082	3	0.000*
Well-planned/Poorly planned	2.92 (1.69) A	3.33 (1.52) B	2.80 (1.49) A	3.57 (1.47) B	11.664	3	0.000*
Large/Small	2.84 (1.48) A	3.30 (1.52) B	2.77 (1.42) A	3.40 (1.54) B	9.998	3	0.000*
Free/Restricted	3.39 (1.72) AB	3.78 (1.60) B	3.05 (1.66) A	3.79 (1.65) B	9.949	3	0.000*
Simple/Complex	2.64 (1.45) A	3.32 (1.58) B	2.87 (1.60) A	3.44 (1.65) B	12.592	3	0.000*
Peaceful/Disturbing	3.26 (1.61) A	3.91 (1.70) B	3.06 (1.57) A	4.00 (1.66) B	17.916	3	0.000*
Uncrowded/ Crowded	2.98 (1.60) A	3.62 (1.64) B	2.93 (1.55) A	3.74 (1.69) B	14.581	3	0.000*

*Note: Cells show M (SD) followed by the Tukey HSD homogeneity group. * significant at p < 0.001. M: Mean value, SD: Standard deviation, F: F value, df: Degrees of freedom. Mean values of variables ranked from 1 to 7; higher values indicate more negative responses.*

The mean values given in Table 4 show that there are significant differences between participants' perceptual evaluations of the physical environmental factors of office spaces using wooden wall coverings arranged in four different ways. According to the results of the one-way analysis of variance conducted to determine whether these differences are statistically significant, significant differences were found for all adjective pairs constituting the semantic differential scale (at the $p < 0.001$ level). These results are expressed graphically in Figure 2.

As seen in Figure 2, there are significant differences between participants' perceptual evaluations of the physical environmental factors of office spaces using wooden wall coverings arranged in four different ways. According to the results of the Tukey HSD post-hoc analysis, significant differences were found in thirteen of the fifteen adjective pairs examined (beautiful/ugly, bright/dark, roomy/cramped, attractive/repulsive, airy/gloomy, high/low, orderly/disorderly, well-planned/poorly planned, large/small, free/restricted, simple/complex, peaceful/disturbing and uncrowded/crowded) between light-toned spaces (square-light and circular-light) and dark-toned spaces (square-dark and

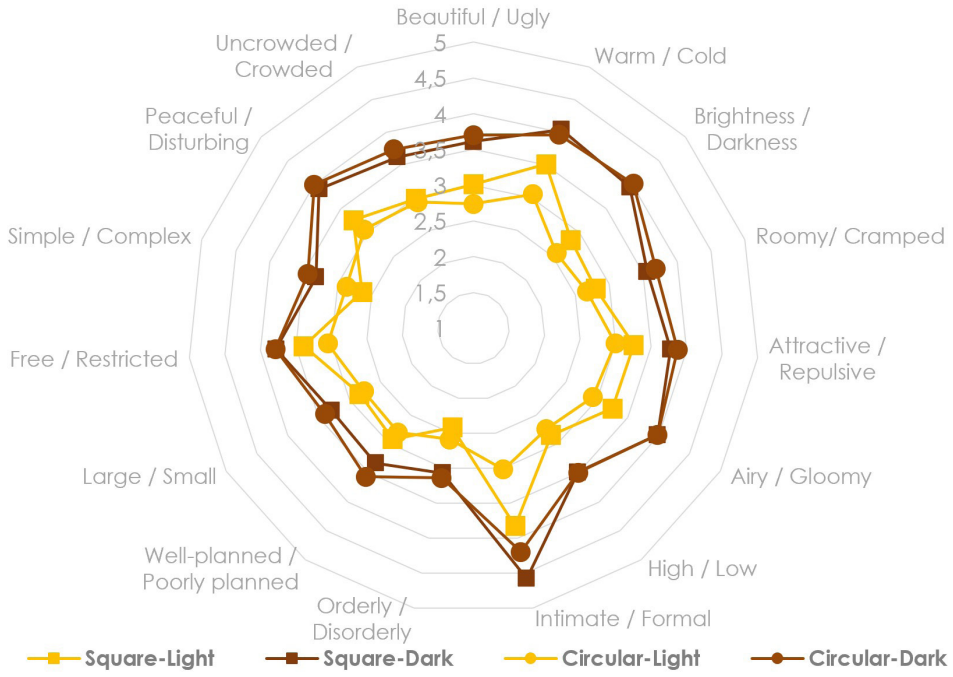


Figure 2. Mean evaluations relating to the wooden wall coverings used in office spaces (produced by the authors).

circular-dark); in general, light-toned spaces were assigned to homogeneity group A, whereas dark-toned spaces were assigned to homogeneity group B ($p < 0.05$). In general, light-toned spaces did not differ significantly among themselves, nor did dark-toned spaces among themselves.

On the other hand, the effect of form came to the fore in the warm/cold and intimate/formal adjective pairs. In the warm/cold dimension the circular-light space alone was determined as homogeneity group A (the warmest), while the square-light space fell into homogeneity group B and the dark-toned spaces into homogeneity group C (the coldest). Similarly, in the intimate/formal dimension the circular-light space alone was determined as homogeneity group A (the most intimate); this indicates that the circular form, when used together with a light colour tone, has a marked positive effect on the perception of intimacy and warmth.

These results show that the form (square/circular) and colour tone (light/dark) variables of the wooden wall coverings used in office spaces have important effects on participants' perceptual evaluations. They reveal that the effect of colour tone is generally more dominant than that of form, whereas the effect of form emerges distinctly in the affective and relational dimensions in particular (warmth and intimacy).

Findings Related to Gender

The mean and standard deviation values and ANOVA test results covering the differences between participants' spatial perceptions of the physical environmental factors of office spaces using wooden wall coverings according to gender are given in Table 5.

As shown in Table 5, significant differences (at the $p < 0.05$ level) were found between participants' spatial perceptions of the physical environmental factors of office spaces using wooden wall coverings according to gender for the adjective pairs warm/cold ($p = 0.011$), attractive/repulsive ($p = 0.007$), simple/complex ($p = 0.034$) and peaceful/disturbing ($p = 0.009$).

Table 5. Results relating to participants' evaluations according to gender (produced by the authors).

Dependent variables	Female	Male	F	df	Sig.
Beautiful/Ugly	3.34 (1.75)	3.16 (1.69)	2.357	1	0.125 ns
Warm/Cold	3.77 (1.75)	3.47 (1.65)	6.490	1	0.011*
Brightness/Darkness	3.42 (1.80)	3.25 (1.59)	1.994	1	0.158 ns
Roomy/Cramped	3.14 (1.68)	3.24 (1.54)	0.738	1	0.391 ns
Attractive/Repulsive	3.61 (1.72)	3.30 (1.63)	7.256	1	0.007*
Airy/Gloomy	3.62 (1.82)	3.41 (1.55)	3.070	1	0.080**
High/Low	3.12 (1.62)	3.18 (1.53)	0.281	1	0.596 ns
Intimate/Formal	3.99 (1.85)	3.79 (1.85)	2.472	1	0.116 ns
Orderly/Disorderly	2.75 (1.54)	2.88 (1.50)	1.372	1	0.242 ns
Well-planned/Poorly planned	3.22 (1.59)	3.06 (1.56)	2.123	1	0.146 ns
Large/Small	3.01 (1.54)	3.18 (1.47)	2.559	1	0.110 ns
Free/Restricted	3.54 (1.77)	3.45 (1.58)	0.544	1	0.461 ns
Simple/Complex	2.97 (1.66)	3.20 (1.51)	4.492	1	0.034*
Peaceful/Disturbing	3.68 (1.73)	3.38 (1.61)	6.915	1	0.009*
Uncrowded/Crowded	3.28 (1.70)	3.37 (1.60)	0.547	1	0.460 ns

*Note: Cells show M (SD). * significant at p < 0.05 and ** significant at p < 0.10. ns: not significant at p > 0.10. M: Mean value, SD: Standard deviation, F: F value, df: Degrees of freedom. Mean values of variables ranked from 1 to 7; higher values indicate more negative responses.*

No significant gender-related difference was found for the remaining eleven adjective pairs. The graphical representation of these results is given in Figure 3. As seen in Figure 3, male participants perceived office spaces using wooden wall coverings as more beautiful, warm, bright, attractive, airy, intimate, well-planned and peaceful than female participants, whereas female participants perceived them as more roomy, orderly, large and simple than male participants. In general, it may be stated that female participants displayed a more negative attitude in spatial perception than male participants.

Findings Related to Age

The mean and standard deviation values and ANOVA test results covering the differences between participants' spatial perceptions according to age group are given in Table 6.

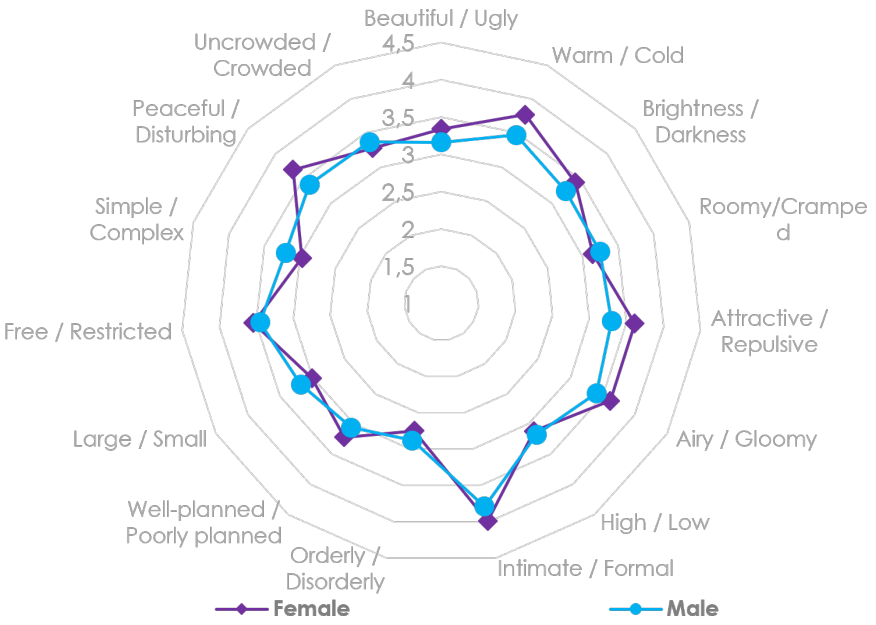


Figure 3. Effect of participants' gender on the dependent variables (produced by the authors).

Dependent variables	18–25	26–35	36–45	46 and over	F	df	Sig.
Brightness/Darkness	3.50 (1.80)	3.39 (1.77)	3.04 (1.41)	3.19 (1.60)	2.393	3	0.067**
Roomy/Cramped	3.27 (1.76)	3.21 (1.66)	3.13 (1.35)	2.90 (1.38)	1.348	3	0.258 ns
Attractive/Repulsive	3.68 (1.58)	3.49 (1.75)	3.25 (1.65)	3.24 (1.68)	2.601	3	0.051**
Airy/Gloomy	3.75 (1.70)	3.47 (1.81)	3.45 (1.54)	3.38 (1.60)	1.847	3	0.137 ns
High/Low	3.23 (1.69)	3.04 (1.55)	3.24 (1.46)	3.24 (1.58)	1.088	3	0.353 ns
Intimate/Formal	4.20 (1.78)	3.91 (1.90)	3.53 (1.70)	3.68 (1.88)	4.308	3	0.005*
Orderly/Disorderly	2.95 (1.61)	2.77 (1.56)	2.80 (1.35)	2.57 (1.35)	1.603	3	0.187 ns
Well-planned/Poorly planned	3.34 (1.57)	3.16 (1.67)	3.09 (1.44)	2.76 (1.28)	3.278	3	0.020*
Large/Small	3.18 (1.53)	3.04 (1.56)	3.19 (1.40)	2.85 (1.42)	1.394	3	0.243 ns
Free/Restricted	3.62 (1.66)	3.57 (1.77)	3.43 (1.57)	3.04 (1.53)	3.037	3	0.028*
Simple/Complex	3.26 (1.68)	2.97 (1.61)	3.19 (1.57)	2.82 (1.35)	2.619	3	0.050**
Peaceful/Disturbing	3.68 (1.60)	3.62 (1.76)	3.49 (1.53)	3.07 (1.69)	3.334	3	0.019*
Uncrowded/Crowded	3.44 (1.66)	3.30 (1.71)	3.41 (1.57)	2.93 (1.52)	2.376	3	0.069**

Table 6. Results relating to participants' evaluations according to age group (produced by the authors).

*Note: Cells show M (SD). * significant at p < 0.05 and ** significant at p < 0.10. ns: not significant at p > 0.10. M: Mean value, SD: Standard deviation, F: F value, df: Degrees of freedom. Mean values of variables ranked from 1 to 7; higher values indicate more negative responses.*

As shown in Table 6, significant differences (at the p < 0.05 level) were found according to participants' age groups for the adjective pairs beautiful/ugly (p = 0.044), warm/cold (p = 0.001), intimate/formal (p = 0.005), well-planned/poorly planned (p = 0.020), free/restricted (p = 0.028) and peaceful/disturbing (p = 0.019). The graphical representation of these results is given in Figure 4.

As seen in Figure 4, young participants in the 18–25 age range evaluated office spaces using wooden wall coverings more negatively than the other age groups; spatial perception developed positively as age increased, and participants aged 46 and over made the most positive evaluations. According to these results it may be stated that perception of offices with wooden materials is positively affected as age groups advance.

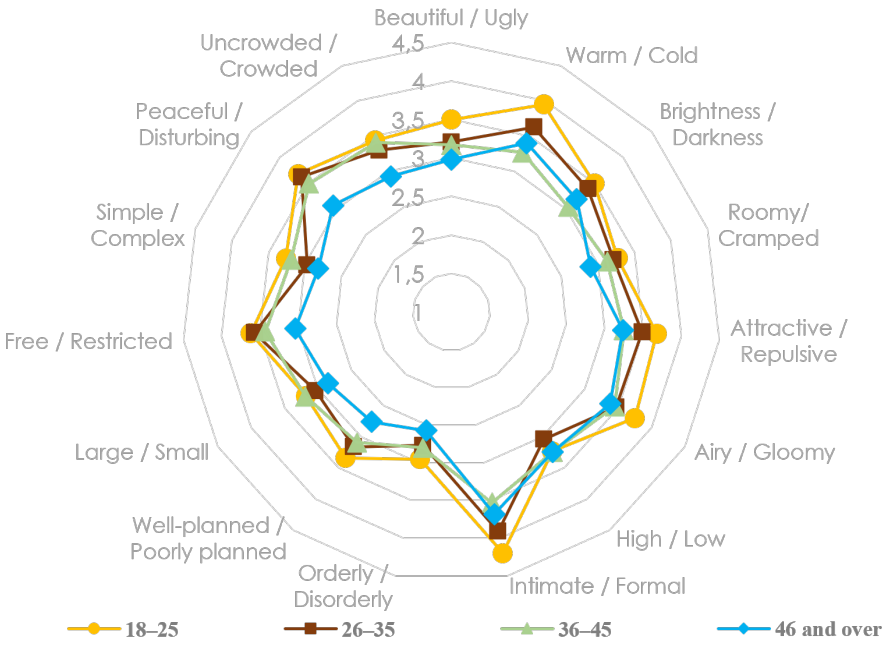


Figure 4. Effect of participants' age groups on the dependent variables (produced by the authors).

Findings Related to Profession

The mean and standard deviation values and ANOVA test results covering the differences between participants' spatial perceptions according to occupational group (architect, engineer, other occupations) are given in Table 7.

As shown in Table 7, significant differences (at the $p < 0.05$ level) were found according to participants' occupational groups for the adjective pairs beautiful/ugly ($p = 0.022$), warm/cold ($p < 0.001$), attractive/repulsive ($p = 0.001$), airy/gloomy ($p = 0.003$), intimate/formal ($p = 0.002$), free/restricted ($p = 0.015$) and peaceful/disturbing ($p = 0.007$). The graphical representation of these results is given in Figure 5.

As seen in Figure 5, architect and engineer participants evaluated office spaces using wooden wall coverings with mean values close to one another, whereas participants in the "other" occupational group evaluated the offices generally more negatively than architects and engineers. These results show that occupational groups with design or technical education, such as architects and engineers, adopt a more positive approach in their perceptions of office spaces than participants in the "other" occupational group.

Table 7. Results relating to participants' evaluations according to occupational group (produced by the authors).

Dependent variables	Architect	Engineer	Other	F	df	Sig.
Beautiful/Ugly	3.11 (1.59)	3.07 (1.60)	3.41 (1.81)	3.852	2	0.022*
Warm/Cold	3.40 (1.60)	3.24 (1.46)	3.91 (1.81)	13.651	2	0.000*
Brightness/Darkness	3.31 (1.64)	3.17 (1.51)	3.44 (1.82)	1.883	2	0.153 ns
Roomy/Cramped	3.24 (1.56)	3.19 (1.51)	3.15 (1.69)	0.207	2	0.813 ns
Attractive/Repulsive	3.22 (1.61)	3.25 (1.61)	3.68 (1.73)	7.634	2	0.001*
Airy/Gloomy	3.31 (1.55)	3.33 (1.50)	3.72 (1.85)	5.977	2	0.003*
High/Low	3.20 (1.51)	3.05 (1.46)	3.16 (1.66)	0.519	2	0.595 ns
Intimate/Formal	3.65 (1.79)	3.69 (1.78)	4.11 (1.88)	6.234	2	0.002*
Orderly/Disorderly	2.83 (1.38)	2.72 (1.35)	2.83 (1.65)	0.401	2	0.670 ns
Well-planned/Poorly planned	3.04 (1.39)	3.00 (1.49)	3.27 (1.68)	2.783	2	0.062**
Large/Small	3.24 (1.53)	3.14 (1.39)	2.99 (1.55)	2.258	2	0.105 ns
Free/Restricted	3.27 (1.52)	3.39 (1.56)	3.65 (1.80)	4.243	2	0.015*
Simple/Complex	3.10 (1.43)	3.26 (1.55)	2.98 (1.68)	2.278	2	0.103 ns
Peaceful/Disturbing	3.36 (1.58)	3.36 (1.58)	3.72 (1.75)	5.011	2	0.007*
Uncrowded/Crowded	3.28 (1.56)	3.40 (1.63)	3.30 (1.71)	0.343	2	0.710 ns

*Note: Cells show M (SD). * significant at $p < 0.05$ and ** significant at $p < 0.10$. ns: not significant at $p > 0.10$. M: Mean value, SD: Standard deviation, F: F value, df: Degrees of freedom. Mean values of variables ranked from 1 to 7; higher values indicate more negative responses.*

Findings Related to Work Experience

The mean and standard deviation values and ANOVA test results covering the differences between participants' spatial perceptions according to length of work experience are given in Table 8.

As shown in Table 8, significant differences (at the $p < 0.05$ level) were found according to participants' lengths of work experience for the adjective pairs warm/cold ($p = 0.001$), attractive/repulsive ($p = 0.002$), airy/gloomy ($p = 0.036$), well-planned/poorly planned ($p = 0.013$), free/restricted ($p = 0.041$) and peaceful/disturbing ($p = 0.009$). The graphical representation of these results is given in Figure 6.

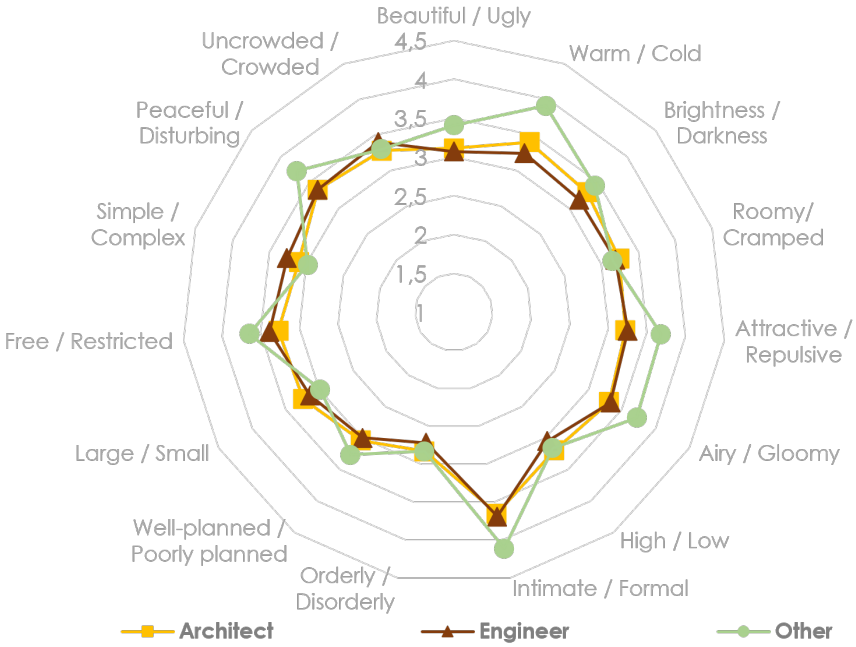


Figure 5. Effect of participants' occupational groups on the dependent variables (produced by the authors).

Table 8. Results relating to participants' evaluations according to years of experience (produced by the authors).

Dependent variables	1–3 years	4–6 years	7–10 years	11 years and over	F	df	Sig.
Beautiful/Ugly	3.35 (1.71)	3.42 (1.78)	2.97 (1.60)	3.17 (1.76)	2.064	3	0.103 ns
Warm/Cold	3.85 (1.77)	3.70 (1.65)	3.26 (1.58)	3.42 (1.66)	5.477	3	0.001*
Brightness/Darkness	3.50 (1.79)	3.25 (1.61)	3.11 (1.59)	3.24 (1.67)	2.303	3	0.076**
Roomy/Cramped	3.19 (1.64)	3.29 (1.82)	3.08 (1.50)	3.16 (1.55)	0.357	3	0.784 ns
Attractive/Repulsive	3.64 (1.60)	3.52 (1.78)	2.98 (1.63)	3.41 (1.78)	4.871	3	0.002*
Airy/Gloomy	3.66 (1.73)	3.55 (1.76)	3.13 (1.42)	3.52 (1.80)	2.854	3	0.036*
High/Low	3.17 (1.59)	3.00 (1.65)	3.09 (1.49)	3.21 (1.59)	0.538	3	0.656 ns
Intimate/Formal	4.02 (1.78)	4.10 (1.86)	3.67 (1.77)	3.72 (1.97)	2.370	3	0.069**
Orderly/Disorderly	2.81 (1.54)	2.94 (1.61)	2.78 (1.40)	2.73 (1.52)	0.550	3	0.648 ns
Well-planned/Poorly planned	3.31 (1.54)	3.17 (1.73)	2.81 (1.43)	3.04 (1.60)	3.612	3	0.013*
Large/Small	3.01 (1.46)	3.23 (1.64)	3.03 (1.48)	3.14 (1.56)	0.821	3	0.483 ns
Free/Restricted	3.59 (1.67)	3.63 (1.85)	3.10 (1.46)	3.00 (1.53)	2.762	3	0.041*
Simple/Complex	3.02 (1.62)	3.42 (1.78)	2.97 (1.46)	3.00 (1.53)	2.372	3	0.069**
Peaceful/Disturbing	3.71 (1.65)	3.66 (1.71)	3.16 (1.49)	3.43 (1.79)	3.914	3	0.009*
Uncrowded/Crowded	3.30 (1.59)	3.52 (1.87)	3.12 (1.43)	3.33 (1.76)	1.212	3	0.304 ns

*Note: Cells show M (SD). * significant at p < 0.05 and ** significant at p < 0.10. ns: not significant at p > 0.10. M: Mean value, SD: Standard deviation, F: F value, df: Degrees of freedom. Mean values of variables ranked from 1 to 7; higher values indicate more negative responses.*

As seen in Figure 6, participants with 7–10 years of work experience evaluated office spaces using wooden wall coverings more positively than the other experience groups, whereas participants with 1–3 and 4–6 years of work experience perceived the spaces more negatively. Among participants with 11 years or more of experience the scores declined slightly again, which suggests that in the mid-career period (7–10 years) individuals accumulate sufficient professional familiarity and mature their frames of reference regarding office environments.

DISCUSSION

In this section, the findings obtained in the present study are discussed in comparison with previous studies in this field. The research examined the effects

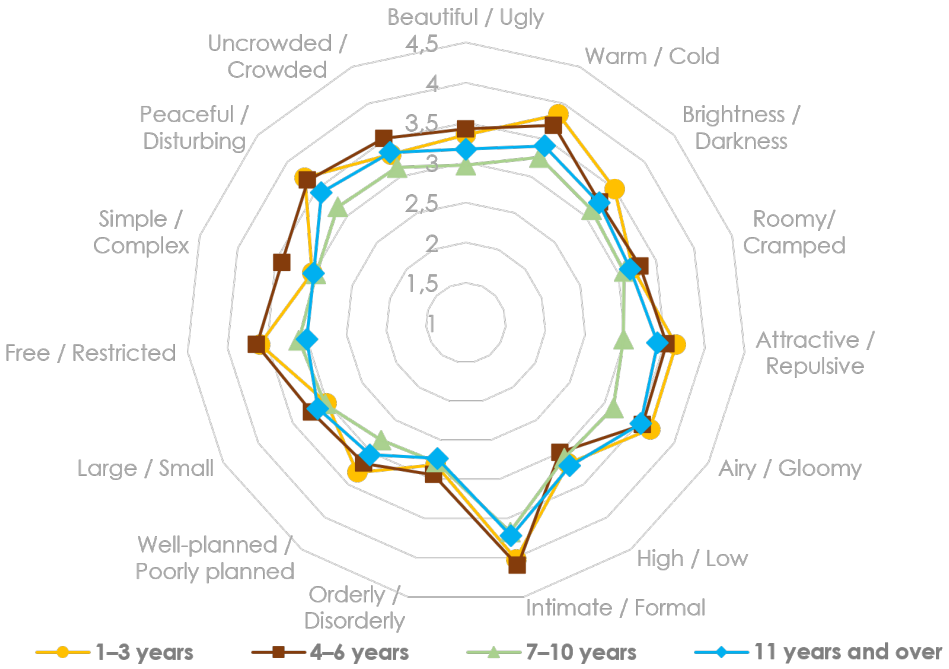


Figure 6. Effect of participants' work experience groups on the dependent variables (produced by the authors).

of the geometric form (square/circular) and colour tone (light/dark) variables of wooden wall coverings used in office spaces, together with participants' demographic characteristics (gender, age, profession and work experience), on spatial perception. The findings obtained revealed significant differences for all six hypotheses. While some of the findings show direct parallels with studies in the literature, findings relating to certain demographic variables diverge from the tendencies reported there.

According to the research findings, the form of the wall covering (square/circular) used in office spaces has a significant effect on participants' perceptual evaluations. The dimension in which the effect of form manifested itself most distinctly on its own was intimacy and warmth; spaces using circular-form and light-toned coverings were perceived as more intimate and warmer than the other space types. This result supports the findings obtained in the studies of Banaei et al. (2017), Dazkir and Read (2012), Vartanian et al. (2013) and Yıldırım and Müezzinoğlu (2024), which reveal the positive effect of circular forms on affective and relational dimensions. Vartanian et al. (2019) further demonstrated that the preference for curvilinear contour in interior architectural spaces holds among both experts and non-experts, which is consistent with the fact that in the present study the advantage of the circular-light condition emerged across the sample as a whole. In addition, in an earlier study by Yıldırım et al., 2021, which examined three different geometric forms in bedrooms, the circular-form wall panel was found to be perceived as warmer, more intimate, more attractive and more peaceful than square and triangular forms, and this finding directly supports the form finding of the present study. On the other hand, in the remaining perceptual dimensions the effect of form did not emerge as distinctly as the effect of colour tone. This suggests that form operates primarily on the affective register of spatial experience, while the perceptual dimensions concerning luminance, spaciousness and order are governed predominantly by colour tone.

The strongest finding obtained in the research is the determining effect of the colour tone (light/dark) of the wooden wall covering on perceptual evaluations. In almost all of the fifteen perceptual dimensions examined, spaces using

light-toned wooden coverings were evaluated statistically significantly more positively than spaces using dark-toned coverings ($p < 0.001$). This result shows a direct parallel with the study of Coşgun et al. (2022), which is the work most directly related to the research subject and methodologically closest to the present study; that study tested wooden, concrete and metal wall coverings in café environments and determined that light-coloured wooden coverings were the warmest and generally the most positively evaluated covering. Furthermore, the studies conducted by the same research group on colour strongly support this finding: Yıldırım et al. (2007a) in a real café-restaurant environment, Yıldırım et al. (2011) in two different living rooms, Yıldırım, Çağatay and Ayalp (2015a) in classroom environments, Hidayetoğlu et al. (2012) in the context of indoor wayfinding, and Aksoy Özler et al. (2023) in interior spaces, all determined that light and warm colour tones produced significantly more positive perceptual evaluations than dark tones. The finding is also consistent with the international literature. Zhu et al. (2023) determined that offices with light- and medium-toned wood were aesthetically evaluated more positively than those with dark tones, and that lower wood coverage was preferred to higher coverage; Poirier et al. (2019) found that light-coloured wood coverings in daylit interiors contributed to brighter and more relaxing environments while dark walnut was found darker and duller. Kwallek (1996) and Kwallek et al. (1997, 2005) likewise demonstrated that light wall tones increase the perception of spaciousness in offices and positively affect mood and performance. The convergence of these findings indicates that the luminance level of the wall surface functions as a primary determinant of interior perception across space types and cultures.

The research findings revealed that participants' gender has a significant effect on spatial perception. Female participants evaluated the spaces more critically than male participants in the dimensions of warmth, attractiveness and peacefulness, whereas in the dimension of simplicity male participants perceived the spaces as more complex. This result shows a direct parallel with the gender difference results consistently obtained by the same research group in different space types: Yıldırım et al. (2007a) in a café-restaurant environment, Yıldırım et al. (2007b) in open-plan offices, Coşgun et al. (2022) in a wall covering material study and Ergün et al. (2023) in an open-plan office study all determined that male participants evaluated spaces more positively than female participants. In an earlier study by Yıldırım et al., 2024, female participants likewise evaluated bedroom environments more negatively in fourteen of the fifteen adjective pairs. Poirier et al. (2019) similarly reported that female participants evaluated dark-coloured environments more negatively. The consistency of this pattern across space types suggests that gender-related differences in environmental evaluation are systematic rather than incidental, and that they should be taken into account particularly in the design of shared work environments.

The research determined that participants' age groups have a significant effect on spatial perception; young participants in the 18–25 age range evaluated the spaces more negatively than the other age groups, spatial perception developed positively as age increased, and participants aged 46 and over made the most positive evaluations. This result shows a direct parallel with two recent studies. Yan and Guo (2023) found an inverted-U relationship between the proportion of wood covering and psychological acceptance in the activity rooms of elderly care buildings in China, and revealed that elderly participants evaluated wooden spaces positively. Mao et al. (2024) demonstrated that age has significant effects on design evaluation in office environments; while determining that the combination of wooden flooring and brown furniture was the most positively evaluated condition on average, they found that when age groups were examined separately, older participants distinctly preferred wooden

textures. Stamps (1999) likewise reports in his meta-analysis that age is among the demographic variables producing systematic effects in environmental aesthetics. The finding may be interpreted through the mere exposure effect described by Zajonc (1968): older participants, having accumulated longer exposure to wood-clad work environments, may have developed more positive attitudes towards them.

The research findings revealed that participants' occupational groups have a significant effect on spatial perception. While architect and engineer participants evaluated the office spaces with mean values close to one another, participants in the "other" occupational group evaluated the spaces distinctly more negatively. This result was not found to be consistent with the findings of an earlier study by Yıldırım et al., 2024, in which architects and interior architects made more negative evaluations than engineers and other occupational groups in thirteen of fifteen adjective pairs in bedrooms. Nor is it consistent with the studies of Coşgun et al. (2022) and Ergün et al. (2023), which determined that participants with design education made more critical evaluations, or with the finding of Gifford et al. (2002) and Yazdanfar et al. (2015) that architects and laypersons judge buildings differently. This divergence may be explained in part by the fact that the space evaluated in the present study is an office environment: architects and engineers, being themselves habitual users of office environments, may have evaluated the presented scenarios against a professional frame of reference in which the modelled offices appeared of above-average quality, whereas participants in the "other" group, whose occupational experience of office environments is more heterogeneous, may have applied a different and more demanding standard. The finding indicates that the effect of professional education on perception is not uniform across space types but is contingent on the degree to which the space type coincides with the evaluator's own professional experience. This constitutes the point at which the present study most clearly diverges from the literature, and it merits further investigation.

The research findings revealed that participants' lengths of work experience have a significant effect on spatial perception; participants with 7–10 years of work experience evaluated the spaces most positively among the groups, while participants with 1–3 and 4–6 years of experience made more negative evaluations. This result supports the findings obtained in the studies of Hidayetoğlu et al. (2010), which revealed that spatial experience systematically affects perception, and of Erdoğan et al. (2013), which stated that familiarity is an important antecedent of positive perception. Zajonc's (1968) mere exposure effect and Purcell's (1986) schema discrepancy model explain the effect of work experience from two complementary perspectives. According to Zajonc's model, the fact that the 7–10 year experience group, corresponding to the mid-career period, made the most positive evaluations may be explained by these individuals having accumulated sufficient professional familiarity and developed positive attitudes towards office environments. Purcell's schema discrepancy model, on the other hand, explains the negative evaluations in the early career period (1–3 and 4–6 years): these individuals, who still have limited office experience, may have perceived a greater discrepancy between the idealised office image they hold and the space presented, and therefore made more critical evaluations. This situation also largely coincides with the findings for the young (18–25) age group in the present study, which suggests that age and work experience operate through a shared mechanism of familiarity and schema formation.

CONCLUSION

This research aimed to determine the effects of the geometric form (square/circular) and colour tone (light/dark) variables of wooden wall coverings used in office spaces, together with participants' demographic characteristics (gender, age, profession and work experience), on users' perceptual evaluations. In the research, 219 participants experienced four different office scenarios (square-light, square-dark, circular-light, circular-dark) supported by 360-degree virtual space tours and were asked to make evaluations on a seven-point semantic differential scale composed of fifteen adjective pairs.

According to the results obtained in relation to the geometric form of the wooden wall covering, the dimension in which the effect of form manifested itself most distinctly on its own was intimacy and warmth. Spaces using circular-form coverings were perceived as more intimate and warm than spaces using square-form coverings, whereas in the other perceptual dimensions the effect of form did not emerge as distinctly as the effect of colour. According to these findings, hypothesis H1, which predicted that circular-form coverings would be perceived more positively than square-form coverings, was partially supported. According to the results obtained in relation to the colour tone of the wooden wall covering, statistically significant results were obtained for all fifteen adjective pairs ($p < 0.001$). Spaces using light-toned wooden coverings were perceived as more beautiful, warm, bright, roomy, attractive, airy, intimate, well-planned, simple and peaceful. According to these findings, hypothesis H2, which predicted that light-toned coverings would be perceived more positively than dark-toned coverings, was supported.

In the evaluation made according to participants' gender, significant differences were determined for the adjective pairs warm/cold, attractive/repulsive, simple/complex and peaceful/disturbing. Female participants perceived the office spaces as colder, more repulsive and more disturbing than male participants, while male participants perceived the spaces as more complex than female participants. According to these findings, hypothesis H3, which predicted that female participants would evaluate the spaces more negatively than male participants, was partially supported.

In the evaluation made according to participants' age groups, significant differences were determined for the adjective pairs beautiful/ugly, warm/cold, intimate/formal, well-planned/poorly planned, free/restricted and peaceful/disturbing. Participants in the 18–25 age group evaluated the spaces most negatively, and participants aged 46 and over evaluated the spaces most positively. According to these findings, hypothesis H4, which predicted that there would be significant differences between age groups in terms of perceptual evaluation, was supported.

In the evaluation made according to participants' professions, significant differences were determined for the adjective pairs beautiful/ugly, warm/cold, attractive/repulsive, airy/gloomy, intimate/formal, free/restricted and peaceful/disturbing. While architect and engineer participants evaluated the office spaces with mean values close to one another, participants in the "other" occupational group evaluated the spaces distinctly more negatively. According to these findings, hypothesis H5, which predicted that architect and engineer participants would evaluate the spaces more negatively than other occupational groups, was not supported; contrary to the prediction, the difference arose from the more negative evaluations of participants in the other occupational group.

In the evaluation made according to participants' lengths of work experience, significant differences were determined for the adjective pairs warm/cold, attractive/repulsive, airy/gloomy, well-planned/poorly planned, free/restricted and peaceful/disturbing. Participants with 7–10 years of work experience evaluated the spaces most positively, while participants with 1–3 and 4–6 years of experience made more negative evaluations. According to these findings, hypothesis H6, which predicted that there would be significant differences between lengths of work experience in terms of perceptual evaluation, was supported.

Taken together, these results indicate that in office interiors the luminance of the wood tone is the primary determinant of perceptual quality, while covering geometry operates as a secondary but distinct instrument acting specifically on the affective register of the environment. For designers, this suggests a two-stage decision logic: light wood tones should be preferred as the default where a positive general perception is sought, and circular or curvilinear covering geometries should be introduced where warmth and intimacy are the intended atmospheric qualities, as in reception areas, meeting rooms or collaborative zones within open-plan offices. The demographic findings further indicate that a single design solution will not be perceived uniformly by all user groups, and that the demographic composition of the intended user population should be considered as a design input rather than an afterthought.

The following recommendations are offered for the development of this study. Addressing the findings obtained from virtual office spaces in real office environments in future research will increase the generalisability of the results and broaden the contribution to the literature. The study focused predominantly on visual perception; more comprehensive research taking into account multisensory variables such as tactile perception, acoustic comfort and lighting may be conducted. Only two geometric forms, square and circular, were addressed in the present study; in future studies the inclusion of different formal arrangements such as triangular, hexagonal, organic or free forms may reveal the effect of form on spatial perception more comprehensively. The colour variable was examined through two tones, light and dark; studies addressing different colour families (warm–cool), saturation levels and colour combinations together may investigate the effect of colour on spatial perception in greater depth. Finally, the present research was limited to the office environment; examining similar variables in spaces of different functions such as housing, educational buildings, healthcare facilities and accommodation buildings may increase the generalisability of the findings.

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Conflict of Interest

No conflict of interest was declared by the authors.

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Ethics Committee Approval

Ethics committee approval was obtained from ethics committee of the Gazi University, dated 11.07.2025 and numbered 2025 - 1225.

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REFERENCES

Ahmed, M. S., Nessim, A. A., & Fathy, F. M. (2024). Evaluating thermal perception of different wall colors in workplaces using virtual reality. *Engineering Research Journal (ERJ)*, *53*(4), 241–247. https://doi.org/10.21608/erjsh.2024.317047.1346

Akalın, A., Yıldırım, K., Wilson, C., & Kılıçoğlu, Ö. (2009). Architecture and engineering students' evaluations of house façades: Preference, complexity and impressiveness. *Journal of Environmental Psychology*, 29(1), 124–132. https://doi.org/10.1016/j.jenvp.2008.05.005

Aksoy Özler, K., Hidayetoğlu, M. L., & Yıldırım, K. (2023). Effect of wall colors and usage rates on the perception of interior spaces. *Gazi University Journal of Science*, *36*(3), 965–982. https://doi.org/10.35378/gujs.1120440

Alici, N., & Paktaş, M. G. (2020). İç mekânda renk algısı ve psikolojiye etkileri [Colour perception in interior space and its effects on psychology]. *Modular Journal*, *3*(1), 89–105.

Arnheim, R. (1974). *Art and visual perception: A psychology of the creative eye* (New version). University of California Press.

Ateş, E. S., & Özel, Y. (2023). İç mekân tasarımında renk ve biçimin etkinliği [The effectiveness of colour and form in interior design]. *İstanbul Ticaret Üniversitesi Fen Bilimleri Dergisi*, *22*(43), 113–123. https://doi.org/10.55071/ticaretfbd.1133556

Aydınlı, S. (1986). *Mekânsal değerlendirmede algısal yargılara dayalı bir model* [A model based on perceptual judgements in spatial evaluation] [Unpublished doctoral dissertation]. İstanbul Technical University.

Aydıntan, E. (2001). *Yüzey kaplama malzemelerinin iç mekân algısına anlamsal boyutta etkisi üzerine deneysel bir çalışma* [An experimental study on the semantic effect of surface covering materials on interior perception] [Unpublished master's thesis]. Karadeniz Technical University.

Aydıntan, E. (2016). İç mekân yüzey tasarımlarında mesaj-kullanıcı ilişkisi üzerine deneysel bir irdeleme [An experimental examination of the message–user relationship in interior surface design]. *Online Journal of Art and Design*, *4*(3), 41–51.

Aytem, N. M. (2005). *Mimari mekânda renk, form ve doku değişkenlerinin algılanması etkisi* üzerine *deneysel bir* çalışma [An experimental study on the perceptual effect of colour, form and texture variables in architectural space] [Unpublished master's thesis]. İstanbul Technical University.

Banaei, M., Ahmadi, A., Gramann, K., & Hatami, J. (2020). Emotional evaluation of architectural interior forms based on personality differences using virtual reality. *Frontiers of Architectural Research*, 9(1), 138–147. https://doi.org/10.1016/j.foar.2019.07.005

Banaei, M., Hatami, J., Yazdanfar, A., & Gramann, K. (2017). Walking through architectural spaces: The impact of interior forms on human brain dynamics. *Frontiers in Human Neuroscience*, *11*, 477. https://doi.org/10.3389/fnhum.2017.00477

Bayraktar, E., & Kaleli, F. (2007). Sanal gerçeklik ve uygulama alanları [Virtual reality and its application areas]. In *Akademik Bilişim,07: IX. Akademik Bilişim Konferansı Bildirileri (pp. 253-258)*. Dumlupınar University.

Cha, S. H., Zhang, S., & Kim, T. W. (2020). Effects of interior color schemes on emotion, task performance, and heart rate in immersive virtual environments. *Journal of Interior Design*, *45*(4), 51–65. https://doi.org/10.1111/joid.12179

Ching, F. D. K. (2022). *Mimarlık: Biçim, mekân ve düzen* [Architecture: Form, space and order] (G. Aydın, Trans.; 4th ed.). Nobel Akademik Yayıncılık.

Churchill, W. (1943). House of Commons rebuilding. *Parliamentary Debates (Hansard), House of Commons*, *393*, 403–473. His Majesty's Stationery Office.

Coşgun, B., Yıldırım, K., & Hidayetoğlu, M. L. (2022). Effect of wall covering materials on the perception of cafe environments. *Facilities*, *40*(3/4), 214–232. https://doi.org/10.1108/f-07-2021-0060

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297–334. https://doi.org/10.1007/BF02310555

Çomak, S. D. (2020). *İç mekân tasarımında bitirme öğelerinin insan psikolojisine ve mekân algısına etkisi* [The effect of finishing elements in interior design on human psychology and spatial perception] [Unpublished master's thesis]. Işık University.

Dazkir, S. S., & Read, M. A. (2012). Furniture forms and their influence on our emotional responses toward interior environments. *Environment and Behavior*, *44*(5), 722–732. https://doi.org/10.1177/0013916511402063

Elsbach, K. D., & Bechky, B. A. (2007). It's more than a desk: Working smarter through leveraged office design. *California Management Review*, *49*(2), 80–101. https://doi.org/10.2307/41166384

Erdoğan, E., Binici, S., Akalın, A., & Yıldırım, K. (2013). Urban codes: Familiarity, impressiveness, complexity and liking in façades of houses. *Gazi University Journal of Science*, *26*(2), 319–330.

Ergün, B., Yıldırım, K., & Hidayetoğlu, M. L. (2023). Açık ofislerin duvar ve donatı elemanlarında kullanılan renklerin kullanıcıların algısal değerlendirmeleri üzerindeki etkileri [The effects of colours used on the walls and furnishing elements of open offices on users' perceptual evaluations]. *Gazi Üniversitesi Mühendislik Mimarlık Fakültesi Dergisi*, *38*(4), 2465–2476. https://doi.org/10.17341/gazimmfd.1113543

Erkan, M. Ş., & Ozanözgü, E. N. (2022). Ofis yapılarındaki ortak mekânlar ve kullanıcı ilişkisi [Common spaces in office buildings and the user relationship]. *Sanat ve Tasarım Dergisi*, *12*(2), 399–408. https://doi.org/10.20488/sanattasarim.1221713

Ertürk, S. (1984). *Mimari mekânın algılanması üzerine deneysel bir çalışma* [An experimental study on the perception of architectural space] [Unpublished doctoral dissertation]. Karadeniz Technical University.

Gerçek, M. (2020). Geleneksel ve yenilikçi işyeri (ofis) düzeni türlerinin çalışanlar üzerindeki etkileri: Karşılaştırmalı bir derleme çalışması [The effects of traditional and innovative workplace layout types on employees: A comparative review]. *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *55*, 91–116. https://doi.org/10.18070/erciyesiibd.580160

Gibson, J. J. (2015). *The ecological approach to visual perception* (Classic ed.).

Psychology Press.

Gifford, R., Hine, D. W., Muller-Clemm, W., & Shaw, K. T. (2002). Why architects and laypersons judge buildings differently: Cognitive properties and physical bases. *Journal of Architectural and Planning Research*, *19*(2), 131–148.

Güneş, E., Yıldırım, K., & Akkuş, B. (2019). Açık ofislerde kullanılan çalışma masası panel renklerinin çalışanların algısal performansı üzerindeki etkileri [The effects of desk panel colours used in open offices on employees' perceptual performance]. *Online Journal of Art and Design*, *7*(3), 1–15.

Harvard Division of Continuing Education. (2023). *Why workplace culture matters*. https://professional.dce.harvard.edu/blog/why-workplace-culture-matters/

Hasol, D. (2023). *Mimarlık denince…* [Speaking of architecture…] (3rd ed.). YEM Yayın.

Hidayetoğlu, M. L., Yıldırım, K., & Akalın, A. (2012). The effects of color and light on indoor wayfinding and the evaluation of the perceived environment. *Journal of Environmental Psychology*, *32*(1), 50–58. https://doi.org/10.1016/j.jenvp.2011.09.001

Hidayetoğlu, M. L., Yıldırım, K., & Çağatay, K. (2010). The effects of training and spatial experience on the perception of the interior of buildings with a high level of complexity. *Scientific Research and Essays*, *5*(5), 428–439.

İmamoğlu, V. (1975). *Spaciousness of interiors* [Unpublished doctoral dissertation]. University of Strathclyde.

Jiménez, P., Dunkl, A., Eibel, K., Denk, E., Grote, V., Kelz, C., & Moser, M. (2016). Wood or laminate? — Psychological research of customer expectations. *Forests*, *7*(11), 275. https://doi.org/10.3390/f7110275

Kim, J. J., & Rigdon, B. (1998). *Introduction to sustainable design*. National Pollution Prevention Center for Higher Education, University of Michigan.

Klepeis, N. E., Nelson, W. C., Ott, W. R., Robinson, J. P., Tsang, A. M., Switzer, P., Behar, J. V., Hern, S. C., & Engelmann, W. H. (2001). The National Human Activity Pattern Survey (NHAPS): A resource for assessing exposure to environmental pollutants. *Journal of Exposure Analysis and Environmental Epidemiology*, *11*(3), 231–252. https://doi.org/10.1038/sj.jea.7500165

Kroemer, K. H. E., & Kroemer, A. D. (2001). *Office ergonomics*. Taylor & Francis.

Kuban, D. (2002). *Mimarlık kavramları* [Concepts of architecture] (6th ed.). Yapı-Endüstri Merkezi Yayınları.

Kwallek, N. (1996). Office wall color: An assessment of spaciousness and preference. *Perceptual and Motor Skills*, *83*(1), 49–50. https://doi.org/10.2466/pms.1996.83.1.49

Kwallek, N., Soon, K., Woodson, H., & Alexander, J. L. (2005). Effect of color schemes and environmental sensitivity on job satisfaction and perceived performance. *Perceptual and Motor Skills*, *101*(2), 473–486. https://doi.org/10.2466/pms.101.2.473-486

Kwallek, N., Woodson, H., & Lewis, C. M. (1997). Impact of three interior color schemes on worker mood and performance relative to individual environmental sensitivity. *Color Research & Application*, *22*(2), 121–131. https://doi.org/10.1002/(SICI)1520-6378(199704)22:2<121::AID-COL7>3.0.CO;2-V

Lawson, B. (2001). *The language of space*. Architectural Press.

Lefebvre, H. (1991). *The production of space* (D. Nicholson-Smith, Trans.). Blackwell.

Ma, J. H., Erdogmus, E., Kangisser, S., & Yang, E. (2025). A comparative analysis of the effectiveness of immersive virtual reality on end-user design review. *Building and Environment*, *267*, 112237. https://doi.org/10.1016/j.buildenv.2024.112237

Mao, Y., Li, P., & Hao, P. (2024). The effects of wooden furniture color, floor material, and age on design evaluation, visual attention, and emotions in office environments. *Buildings*, *14*(6), 1498. https://doi.org/10.3390/buildings14061498

Mineev, G. (2017). *The impact of immersive virtual reality on effectiveness of educational games* [Unpublished master's thesis]. Utrecht University.

Müezzinoğlu, M. K., Hidayetoğlu, M. L., & Yıldırım, K. (2020). The effects of the wall colors used in educational spaces on the perceptual evaluations of students. *Megaron*, *15*(1), 1–12. https://doi.org/10.14744/MEGARON.2020.87369

Ojala, A., Kostensalo, J., Viik, J., Matilainen, H., Wik, I., Virtanen, L., & Muilu-Mäkelä, R. (2023). Psychological and physiological effects of a wooden office room on human well-being: Results from a randomized controlled trial. *Journal of Environmental Psychology*, *89*, 102059. https://doi.org/10.1016/j.jenvp.2023.102059

Onat, E. (1995). *Mimarlık, form ve geometri* [Architecture, form and geometry]. YEM Yayınları.

Özkan, A., & Yıldırım, K. (2016). Comparison of conventional and computer-aided drafting methods from the view of time and drafting quality. *Eurasian Journal of Educational Research*, *16*(62), 239–254.

Poirier, G., Demers, C. M. H., & Potvin, A. (2019). Wood perception in daylit interior spaces: An experimental study using scale models and questionnaires. *BioResources*, *14*(1), 1941–1968. https://doi.org/10.15376/biores.14.1.1941-1968

Purcell, A. T. (1986). Environmental perception and affect: A schema discrepancy model. *Environment and Behavior*, *18*(1), 3–30. https://doi.org/10.1177/0013916586181001

Rapoport, A. (1977). *Human aspects of urban form*. Pergamon Press.

Rapoport, A. (1990). *The meaning of the built environment*. University of Arizona Press.

Roberson, M. A., & Crumpton, A. D. (2022). *Architecture and leadership: The nature and role of space and place in organizational culture*. Routledge.

Sakuragawa, S., Miyazaki, Y., Kaneko, T., & Makita, T. (2005). Influence of wood wall panels on physiological and psychological responses. *Journal of Wood Science*, *51*, 136–140. https://doi.org/10.1007/s10086-004-0643-1

Savavibool, N., & Moorapun, C. (2017). Effects of colour, area, and height on space perception. *Environment-Behaviour Proceedings Journal*, *2*(6), 351–359. https://doi.org/10.21834/e-bpj.v2i6.978

Sherman, W. R., & Craig, A. B. (2003). *Understanding virtual reality: Interface, application, and design*. Morgan Kaufmann.

Soygeniş, S. (2023). *Boşlukta gezinirken: Mimari mekânın* öyküsü [Wandering in

the void: The story of architectural space]. YEM Yayın.

Stamps, A. E. (1999). Demographic effects in environmental aesthetics: A meta-analysis. *Journal of Planning Literature*, *14*(2), 155–175. https://doi.org/10.1177/08854129922092630

Tutar, A. Y., & Yıldırım, K. (2023, April 18–19). *Açık ofislerin duvar kaplaması düzeninin kullanıcıların mesleğine göre algısal değerlendirmeleri* üzerindeki *etkileri* [The effects of open office wall covering layout on users' perceptual evaluations according to profession] [Conference presentation]. 4th International Dicle Scientific Research and Innovation Congress (ISARC), Şanlıurfa, Türkiye.

Vartanian, O., Navarrete, G., Chatterjee, A., Fich, L. B., Leder, H., Modroño, C., Nadal, M., Rostrup, N., & Skov, M. (2013). Impact of contour on aesthetic judgments and approach-avoidance decisions in architecture. *Proceedings of the National Academy of Sciences*, *110*(Suppl. 2), 10446–10453. https://doi.org/10.1073/pnas.1301227110

Vartanian, O., Navarrete, G., Chatterjee, A., Fich, L. B., Leder, H., Modroño, C., Rostrup, N., Skov, M., Corradi, G., & Nadal, M. (2019). Preference for curvilinear contour in interior architectural spaces: Evidence from experts and nonexperts. *Psychology of Aesthetics, Creativity, and the Arts*, *13*(1), 110–116. https://doi.org/10.1037/aca0000150

Yan, D., & Guo, Q. (2023). Effect of indoor wall wood coverage on the elderly group — A case study of activity rooms in old-age buildings. *Buildings*, *13*(8), 2086. https://doi.org/10.3390/buildings13082086

Yazdanfar, S. A., Heidari, A. A., & Aghajari, N. (2015). Comparison of architects' and non-architects' perception of place. *Procedia — Social and Behavioral Sciences*, *170*, 690–699. https://doi.org/10.1016/j.sbspro.2015.01.071

Yıldırım, K. (1999). Günümüz konut mutfağında donatı elemanları üzerine bir araştırma [A study on furnishing elements in the contemporary residential kitchen]. *Politeknik Dergisi*, *2*(4), 7–14.

Yıldırım, K., Başkaya, A., & Hidayetoğlu, M. L. (2005). Farklı sosyo-ekonomik düzeye sahip blok-konut kullanıcılarının sabit iç donatım elemanlarından memnuniyeti [Satisfaction of block-housing users of different socio-economic levels with fixed interior furnishing elements]. *Politeknik Dergisi*, *8*(2), 189–197.

Yıldırım, K., Akalın-Başkaya, A., & Hidayetoğlu, M. L. (2007a). Effects of indoor colour on mood and cognitive performance. *Building and Environment*, *42*(9), 3233–3240. https://doi.org/10.1016/j.buildenv.2006.07.037

Yıldırım, K., Akalın-Başkaya, A., & Çelebi, M. (2007b). The effects of window proximity, partition height, and gender on perceptions of open-plan offices. *Journal of Environmental Psychology*, *27*(2), 154–165. https://doi.org/10.1016/j.jenvp.2007.01.004

Yıldırım, K., Hidayetoğlu, M. L., & Şen, A. (2007c). Farklı mimari biçimlerdeki kafe/pastane mekânlarının kullanıcıların algı-davranışsal performansı üzerine etkisi [The effect of café/patisserie spaces of different architectural forms on users' perceptual-behavioural performance]. *Politeknik Dergisi*, *10*(3), 295–301.

Yıldırım, K., Hidayetoğlu, M. L., & Çapanoğlu, A. (2011). Effects of interior colours on mood and preference: Comparisons of two living rooms. *Perceptual and Motor Skills*, *112*(2), 509–524. https://doi.org/10.2466/24.27.PMS.112.2.509-524

Yıldırım, K., Çağatay, K., & Ayalp, N. (2015a). Effect of wall colour on the

perception of classrooms. *Indoor and Built Environment*, *24*(5), 607–616. https://doi.org/10.1177/1420326X14526214

Yıldırım, K., Çağatay, K., & Hidayetoğlu, M. L. (2015b). The effect of age, gender and education level on customer evaluations of retail furniture store atmospheric attributes. *International Journal of Retail & Distribution Management*, *43*(8), 712–726. https://doi.org/10.1108/IJRDM-01-2013-0034

Yıldırım, K., Müezzinoğlu, M. K., & İnan, B. (2021). Yatak odalarında farklı geometrik formların kullanıldığı duvar panellerinin kullanıcıların algısal değerlendirmeleri üzerindeki etkisi [The effect of wall panels using different geometric forms in bedrooms on users' perceptual evaluations]. *Mimarlık Bilimleri ve Uygulamaları Dergisi (JASA)*, *6*(2), 662–675.

Yıldırım, K., & Müezzinoğlu, M. K. (2024). The perceptual effect of forms used on walls and furnishings in cafés. *Facilities*, *42*(7/8), 694–708.

Yıldırım, K., Müezzinoğlu, M. K., Şahin, S., & İnan, B. (2024). The effect of bedroom wall colors on users' perceptual performance. *DEPARCH Journal of Design Planning and Aesthetics Research*, *3*(2), 189–208. https://doi.org/10.55755/DepArch.2024.34

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, *9*(2, Pt. 2), 1–27. https://doi.org/10.1037/h0025848

Zhu, Y., Wang, Q., & Zhao, F. (2023). Wood in office spaces: The impact of different wooden furniture on aesthetic evaluation. *Frontiers in Psychology*, *13*, 986627. https://doi.org/10.3389/fpsyg.2022.986627

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