Color Associations in Landscape Design and Subscription Levels to These Associations

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Abstract

In the present study, a two-tiered research method was adopted. In the first stage, a literature review was conducted to determine the associations that landscape colors evoke in individuals and each association was converted into a statement for each color. The developed 5-point Likert-type scale was submitted for expert opinion (N = 200) and factor analysis was conducted on the findings to determine correlated sub-factors and categorized in the same factor. Thus, the statements in the 1st factor group were mainly physical associations and named as physical associations. The second factor group was named emotional associations, and the third factor group was named behavioral associations. Thus, the survey form that will be used in the second study stage was finalized. The factor analysis was also conducted to reduce the number of statements in the scale. Furthermore, 102 statements with a factor load of below 0.20 were excluded. Thus, the final scale included 34 physical, emotional and behavioral associations in 3 dimensions. In the second stage, the final 5-point Likert-type survey form was applied to the expert group (N = 200) and the participants (N = 200) to determine the agreement of these two groups with the associations. Also, the differences between the agreement levels of the two groups with the associations and the differences between the associations were determined.

The statistical analyses revealed that there was a difference between the mean association scores of the participant and the expert groups in 3 factors (physical association, emotional association and behavioral association) at 0.05 significance level (sig. 0.000, F = 34.432). The direction and size of the correlations between the factors were determined with the correlation analysis, multiple regression analysis was conducted to determine the effect of the factors on others, and it was determined that there was a positive significant correlation between 1st factor and agreement, and a negative significant correlation between the 2nd and 3rd factor groups and agreement. The order of the factors that explained the variation in agreement was the 1st factor (ß =, 332; p = 0.000), the 2nd factor (ß = -, 274; p = 0.000), and the 3rd factor (ß = -, 157; p = 0.001), respectively.

1. Introduction

1.1 Landscape design and color

The significant visual features of design elements include color, as well as line, scale and form. In landscape design, color is mostly observed on plant leaves, flowers, seeds, shoots and stems in landscapes. Plants are living organisms that adapt to the environment with their colors to survive and reproduce. Plant colors and fruits create points of attraction during pollination, while they imitate the environment to deter pests (Kara, 2013; Aşur and Alpman, 2018; Altınçekiç, 2000; Zeren et.al, 2017; Taş, 2019).

Color is associated with perception, and can evoke sensory, behavioral, physical meanings and strong ereactions. Almost everyone, subconsciously or consciously, reacts to colors (Sharpe, 1974; Williams & Patterson, 1999). Although these reactions include emotions such as pleasure, happiness, energy,

calmness, excitation or discomfort, they are almost always immediate (Stanley, 2006; Menatti, & Casado Da Rocha, 2016; Rosen, & Purinton, 2004; Fraser, & Banks, 2004). In addition to creating emotions of well-being, pleasure, peace, contrast, excitement and energy in a space, colors could also lead to perceptions such as warm or cold, light or dark, happiness or sadness (Valdez & Mehrabian, 1994; Hanada, 2018; Ou et.al, 2018; Wilms, & Oberfeld, 2018; Chetverikov, et.al, 2017; Kou et.al, 2021; You et.al, 2000; Yılmaz et.al, 2018, Çorbacı et.al, 2018; Düzenli et.al, 2018).

Like plants, humans exhibit certain reactions to colors throughout their development, and it was scientifically evidenced that these reactions are associated with survival, similar to other living beings. For instance, the combination of yellow and black is considered a danger signal, and we know that we should beware when we see yellow-black wasps. These adaptations and reactions have developed through centuries of experience. Throughout history, people believed in the healing power of colors. Colors have psychological effects; thus, spatial colors could be manipulated to obtain specific reactions. In design, a space painted in an attractive red always raises interest and increases the body temperature. On the contrary, the same space painted in cool shades of blue could have the opposite effect, leading to a feeling of calm and comfort by reducing blood pressure, heart rate and brain waves. Thus, it is possible to employ color in design to manipulate individuals' reactions and spatial perceptions (Al-Zamil, 2017; Hamdy Mahmoud, 2017; costa et.al, 2018; Delcampo - Carda et.al, 2018; Yıldırım et.al, 2019 ; Banaei et al, 2020; Ma et.al, 2020).

In recent years, the rapid horticultural advances in landscape design led to several color choices for designers. The use of leafy and flowering plants in several colors in plant design demonstrated the increasing importance of color in landscaping. In addition to its biological functions, color allows the creation of pleasant effects in landscape compositions. For successful use of plant colors, knowledge on the concepts of color and color harmony and the analysis of color options are required in design. Adequate choice of color adds significant value and expression to the composition, while inadequate color combinations would lead to undesired and boring space (Strawberry and Strawberry 2020; Ma et.al, 2020; Saeedi and Dabbagh, 2020; Lee at.al, 2020).

Basic knowledge on color use is adapted from fine arts and especially painting in landscape design. However, there are certain differences between color use in planting design and painting. First, the space depicted in a painting usually reflects the colors visible for an exact moment. Second, when the colors with different pigments in a painting, it is predominantly perceived as black, while when the plants with different pigments are combined in a space, white or whitish colors are most likely prominent (Yazdanpanah et.al., 2020; Kou et.al, 2021; Wilms, & Oberfeld, 2018).

Certain color theories could be used in landscape design. Color theories are quite complex, and systematic studies on modern color theories date back to the 1800s. The development of modern color theory began in Goethe's book "The Theory Of Colors" published in 1840 (Eastlake, 2020). Numerous studies have been conducted on colors and perception since then. To solve the mystery of the colors, British physicist Newton bended the sunlight with a prism and reflected the seven colors on a curtain,

similar to the rainbow. Newton and next generation of color scientists allowed the designers to apply the knowledge on colors (Esposito, 2020). Based on the color theories, the assessment of color is subjective. Perception, personal experiences, and pleasure influence the assessment (Kim et.al, 2020; Guo et.al, 2020). A better understanding of color perception would be an advantage in spatial plant selection. The first step to determine the color in design is the understanding of basic color concepts and develop a general language for color. Thus, it is necessary to know how colors are associated, how they look in various lighting conditions, how colors affect individuals, and how they create a spatial mood. Color is an optical illusion that occurs when light is absorbed or reflected by object surfaces. In other words, color is the result of a reaction to light in human eye retina The light that reach human eye is physically perceived by the receptors in the retina and interpreted in the brain as the perception of a particular color (Baek et al., 2020).

1.2. Classification of Colors

Color types include neutral, warm, and cold colors based on heat perception. Warm colors are yellow, orange and red. Cool colors are purple, blue-purple, blue-green, and yellow green. Neutral colors are black, white and gray. The warmness, coldness, neutrality or the lightness, darkness and dullness of the colors are effective in spatial design (Yıldırım et.al, 2019). Warm colors consist of red, orange and yellow on the spectrum. These colors have high vibration and radiation, hence visual energy and could be noticed from far away. Due to these properties, they create a convergence effect. Thus, they allow a space appear smaller and distant or large spaces are perceived closer or smaller than they really are. Among these colors, red catches the eye more quickly and allows objects to appear closer. Warm colors are active and dynamic colors; they increase the focus on one area, have stimulating and uplifting effects, provide a sense of mobility, vitality and joy, and create an image of fire, warmth and sun. However, excessive use of these colors could be tiring. While these colors provide a sense of warmth in cold weather, they are suffocating and tiring in hot weather. In spaces with warm colors, time passes faster for the occupants (Yıldırım et.al, 2019; Kuo, & Lai, 2017). Cold colors are associated with the sky, water, ice, forest and shadows and consist of green, blue and purple. Since the physical vibrations of these colors are weaker when compared to warm colors, they have relaxing effects. Thus, cold colors evoke the senses of coolness and calmness. They have chilling effects in cold spaces and cooling and relaxing effects in warm ones. Cool colors exhibit static properties. These colors create a sense or tendency of divergence in the landscape, and the space looks larger that it really is, since these colors have low visual energy. For example, the objects seem further away on a blue background. Although the spaces with cold colors seem farther and smaller than they really are, the background may appear larger than it really is (Altınçekiç, 2000; Yıldırım et.al, 2019). Neutral colors include warm and cool colors, as well as neutral colors such as black, white and gray. Grey is a mixture of black and white. Among neutral colors, white adds lightness and proximity to objects, and black provides depth (Altınçekiç, 2000; Yıldırım et.al, 2019).

Conventional approach to warm and cold colors has sometimes been quite simple. Color theorist Albers (1975) stated in “Interaction Of Color” that the temperature of colors was relative and only perceived when the colors are compared. Thus, it is not always true that warm colors always lead to warm

emotions in plant compositions. According to Albers, green and purple are neither warm nor cool colors and are neutral. If these colors are placed next to warm colors, they could be perceived as warm, and when they are close to cold colors they are perceived as cold (Culp, 2018; Ivanovic & Rossi, 2017). For example, purple feels warm next to a red, and cold when it is next to a blue. Similarly, green is warm when close to yellow, and cold when next to a blue. The lightness and darkness of the colors also lead to differences in spatial perception in design. Black and purple are employed as dark tones, blue, red, and green are employed as middle tones, and orange, yellow and white are employed as light tones in compositions. Dark colors and tones evoke calmness and peace, they evoke depressive emotions when used excessively in the composition. Dark tones have a convergence effect, shortening the distance between the observed and the object (Pernão, 2017). Thus, dark and bright colors, similar to the warm colors, make the space smaller than it really is, and plants with these colors limit and constrict the space. Furthermore, they create a sense of rhythm when used at regular intervals. On the contrary, light colors and tones allow the space to be perceived larger when compared to darker plants. Light colored plants create a sense of spaciousness and evoke the emotions of joy and excitement. Furthermore, light colors are repellents. Thus, light and matte colors make the space look bigger, similar to the cold colors (Savavibool & Moorapun, 2017).

1.3. Color in the world of plants

The effects and intended use of colors that landscape architects utilize in design to create associations and visual impressions are as follows (Aşur, 2019; Manav, 2017; Plass Et. Al, 2020; Disabato-Aust, 2003; Scarfone, 2010; Hansen, 2012; Hansen, & Alvarez, 2010 ; Ahi, 2017; Lee, 2010; Kiang, 2008; Hutchings, 1997). The effects and meanings of colors on individuals and society could vary or change in time. Also, not all colors mean the same for everyone. For example, a red object would be perceived in the same red tone under the same light by everyone with a normal vision; however, but the subconscious reactions to effects of the perceived color would differ for every individual. This is associated with the individual's experiences, psychological state and proximity to the color. One of the aims of the present study was to determine the colors employed in landscape design and the associations of the colors evoked in individuals and to determine the level of agreement with these associations in the participants. These associations could be sensory, physical and behavioral.

Green, a cool color on the color spectrum, leads to emotions of nature, open air and countryside. It is the symbol of nature, strong development, efficiency and abundance, life and vitality. Green, important in religious and mystical beliefs, is the main color of Islam and a symbol of immortality in Christianity. Leaves are generally green in color. However, the tone of the green differs between the species. For example, the leaves of plants such as *Acer buergeranum, Gingko biloba, cupressus macrocarpa 'Goldcrest', Robinia hispida, cytisus laburnum* are light green, those of *Aesculus x carnea, bauhinia variegata, wisteria sinensis, acer tataricum* are medium green, while the leaves of *Acer pseudoplatanus, Aesculus hippocastanum, dark green Crateagus x lavallei, Pinus pinea, Taxus baccata* are very dark green. Furthermore, the leaves of plants such as *Asarum eoropaeum, Fatsia japonica, Ilex latifolia, Prunus lasitonica, acer campestre* are bright green.

Since green is a peaceful, calming and heartwarming color and vitalizes individuals, it is a primary color in landscape design. Since green is the perfect background color, it plays a key role in the relationships between colors. Green is a dominant color, but due to its incredible range of tonal variations, it creates an attractive spatial atmosphere. In design, dark green allows the individuals to distance themselves from the space and yellowish green shortens this distance. On the other hand, light green plants lead to a lighter, cooler and higher mood. Furthermore, transparent plants with bright and light green leaves create a distance between the composition and the observer and the space is perceived wider (Gou et.al, 2020; Mohseni et.al, 2020; Güneş and Olguntürk, 2020; Aşur and Alphan, 2018; Altınçekiç, 2000; Taş, 2019; Sharpe, 1974).

Blue is the color of the sea and sky and the symbol of infinity and eternity. It evokes stability, consistency, continuity, endurance, stability, nobility and accuracy. Blue promotes creative ideas, and is cool, distinctive, distant, calm and shy, and leads to comfortable, tranquil, cool, comfortable and peaceful spaces. It heals and relaxes the nerves and provides an easy thinking and working environment. Since it is a calm and relaxing color, it provides spaciousness and could turn leisure spaces into extremely calm environments. Thus, it could be perceived as a calm color in entertainment venues, although it is also suitable for meditation and thinking spaces, since it prevents psychological depression and reduces stress. Plants with true blue flowers, fruits or leaves are rare in nature. *Diosporus lotus* and *Berberis veitchii* fruits are blue, *Picea pungens Glauca* leaves are blue, *Hydrangea macrophylla, Linum sp., Anagallis sp., Ceanothus skylark*, and *Anchusa azurea* flowers are blue. Most appear in the spring rather than the summer. However, culture and genetic efforts led to the development of several blue plants. The blue colors of these plants are in fact lavender or purple. Most blue flowers also contain red. Blue is a cool color that creates spatial distance, perception of a space larger than it actually is and allows the observer to focus on a distant point. Thus, plants with flowers in short wavelength blue colors are often perceived farther than their actual location and used to create depth in the composition. In the composition, blue creates breathing points between warm colors, as well as binding the colors in thecomposition. Blue could bind different red tones such as lilac, violet and indigo. Furthermore, blue could be used to create shadows, and could be planted in pots and containers (Gou, et.al, 2020; Mohseni et.al, 2020; Güneş and Olguntürk, 2020; Aşur and Alphan, 2018; Altınçekiç, 2000; Taş, 2019; Sharpe, 1974).

Purple is a color with a unique and effective shade with introversion, mysterious, melancholic and mystical effects. Purple, the inspirational color of peace and pursuit, has been used as a symbol of royalty, wealth and knowledge throughout history. In art, purple is used to express the lack of sun and transparent shades. Purple, employed mainly by the impressionists, symbolizes restlessness, mysticism and depth, evokes danger and courage. Short wavelength purple creates spatial distance and adds depth to the composition. Dark purple generally blends easily with other colors. Dark purple offers pleasant and relaxing compositions when used with silver, gray, peach, coral, and rust colors. However, excessive use could lead to depressing and gloomy views and a sense of isolation in the composition. It can also be a soulless and dull color in vibrant environments with inadequate sunlight. Thus, unsaturated lilac and purple could be ineffective in shade; thus, plants in these colors could be used in large patches to create

romantic effects. Plants with purple flowers include *Rhododendron ponticum, Poulounia tomentosa, Hebe Verenica, Calluna vulgaris, Cercis siliquastrum, Magnolia grandiflora, Rosmarinus officinalis, Rhododdendron simirnovii* (Gou, et.al, 2020; Mohseni et.al, 2020; Güneş and Olguntürk, 2020; 2018; Altınçekiç, 2000; Taş, 2019; Sharpe, 1974).

Yellow that represents gold, sun and light is the symbol of wisdom, power and common sense. Yellow has been employed as a royal color like purple and is an inspiring color in bright and pure tones and stimulates intellect. As a dominant color, it draws attention to the space, like the flame of a candle or a magnet. Thus, yellow is perfect to enliven dark spaces and lower parts of the trees. Golden yellow is ideal to enliven shaded areas, and plants with golden leaves on a shady roadside create “luminous spots.” There are several bulbous and perennial plants and shrubs with yellow flowers. Yellow is the color of the spring-blooming daffodil. Plants with yellow stems or those that turn yellow in autumn or with yellow speckles are common in nurseries. *Eounymus japonica* 'Aurea' has yellow leaves, *Acacia dealbata* has light yellow flowers, *Hipophea rhamnoides, Jasminum fruticans, Forsythia x intermedia* blossom yellow flowers in late summer, and *Sparteum junceum, Mohonia aquifolium* are ideal for borders with yellow flowers. The yellow is compatible with almost all colors. However, yellow and golden yellow plants such as *Acer vercilliata, Rhododendron luteum* create a contrast when combined with plants of opposite colors (blue, purple, or even pink). Yellow complements purple. Thus, these plants go well with purples, blues and blue-violets (Regular et.al, 2018; Gou, et.al, 2020; Mohseni et.al, 2020; Güneş and Olguntürk, 2020; Aşur and Alphan, 2018; Altınçekiç, 2000; Taş, 2019; Sharpe, 1974).

Orange is the color of invitation and abundance, children and play. Although it is a warm color, it is not as dynamic as red. When viewed, it evokes warmth, stimulating and heartwarming emotions, happiness, optimism and joy. Orange evokes brightness, wealth, light and efficiency, and it is the color of autumn and flame, symbolizing wisdom, justice, enlightenment and revelation. It offers entertaining spaces for children, and it is also an exotic color. But it cannot be viewed for a long time. In plants, flowers, barks, shoots could be orange, as well as the autumn leaves. While several annual, biannual and perennial plants such as *Eschscholtziai californica* have orange flowers, there are also several woody shrubs with orange fruits that attract birds in the fall. *Euphorbia griffithi*, *Fritillaria imperialis* 'Rubra maxima', *Tulipa, Geum, Helenium* blossoms with orange flowers in spring, *Sorbus sargentiana* leaves turn orange in autumn and has orange shoots in winter. Tilia cordata "Winter orange" and the orange fruits of *Physalis alkegengii* are attractive. Secondary colors such as orange, red and yellow could dominate compatible colors. Several *Graminea* (*Stipa gigantea* and *Calamagrostis*) could create pleasant compositions with attractive pink bronze flowers among orange plants. Thus, reddish brown and earth colors go well with orange. Orange is harmonious with yellow and red plants, while when combined with blue, for example in *Lobelia* and *Tagates* combination, it is shocking. It could be combined with orange bronze or ivory for less striking effects. The complementary blue affects the orange even more in the composition. Bright orange spots in a blue space exhibit dramatic effects and alter the blue balance (Gou, et.al, 2020; Mohseni et.al, 2020; Güneş and Olguntürk, 2020; Aşur and Alphan, 2018; Altınçekiç, 2000; Taş, 2019; Sharpe, 1974).

Red symbolizes danger, aggression, vitality, provocation and war. The light and pure tones of red symbolize love and sensuality, while dark tones reflect excessive passion, anger and stress. Red is the color of desire and warmth, and it is reminiscent of blood, sun and fire. Red is warm, exciting and provocative, symbolizing the red rose and love. Red vibrates is the strongest and most dynamic color in the spectrum. Due to refreshing and active properties, it sometimes encourages individuals to move in a space, sometimes increases the blood pressure. Since it provides positive energy, hope and strength, mental warmth, it could be used near seating furniture or in leisure spaces. Although red is perceived as a single color, there are 2 types of red. Warm red is close to orange, while cold red is closer to purple. The employment of bluish reds with dark colors such as dark blue, purple, bronze and brown leads to a rich space. Since red catches the eye, a bright and vibrant red immediately adds a shock to the composition. Compositions that include red creates a stopping point in our movements. Thus, red could be used to create surprising spaces. Especially in group compositions, dense red spots attract the gaze like a magnet, creating balance and rhythm in the composition. In narrow compositions, depth could be achieved with red on the front and cold colors in the background. However, it may not be right to employ several reds in hospital gardens, since they might create tension, fear and anxiety in long exposure. Due to its demoralizing and depressing effect, it is best to use red in the form of dots. The red blooming plants include *Callistemon citrunus, Chamecyparis japonica, Erica carnea, Erica cinerea, Hibiscus rosa chinensis*. Plants also with leaves that turn red include *Acer palmatum 'Atropurpurea', Prunus ceracifera 'Atropurpurea', Acer crimson king* (Gou, et.al, 2020; Mohseni et.al, 2020; Güneş and Olguntürk, 2020; Aşur and Alphan, 2018; Altınçekiç, 2000; Taş, 2019; Sharpe, 1974).

White is a mixture of all colors. The refreshing white represents goodness, innocence, cleanliness and nobility. It is a symbol of abstract and intelligence. In several cultures, white symbolizes high ideals and divinity. A white garden often creates a sense of freshness, status, intellect, and formality. The white is used to reflect purity, brightness, order and romance and stands out in birch stems, snowdrop flowers, and rowan and snowberry fruits. White flowering plants include *Arbutus unedo, Deutzia scabra, Jasminum officinale, Fatsia japonica, Spirea x vanhouttei, Spirea pruniflora, Rhododendron caucasicum*. White could be combined with almost all colors without problem. White increases the strength of other colors, and they could be combined to create balanced compositions. The stimulating, fresh and delicate effects of white flowers increase when used in groups instead of in combination with other colors. Other colors appear more distinct or darker in a composition with white, increasing contrast and saturation. Red is perceived as crimson on snow. Dark colors such as dark polished greens create a contrast with white, leading to focus in design. Medium gray and green tones go well with white plants, creating a soft effect. White is compatible with bright grays. Color-theme gardens (white gardens) could be designed with white color compositions. Thus, white gardens are a good start for monochromatic color compositions. In such a garden, associations between the white and off-white, cream-yellow or pink, green or lavender flowers should be utilized instead of true white colors to create pleasant expressions (Gou, et.al, 2020; Mohseni et.al, 2020; Güneş and Olguntürk, 2020; Aşur and Alphan, 2018; Altınçekiç, 2000; Taş, 2019; Sharpe, 1974).

Black characterizes gravity and seriousness. Black is the symbol of solitude and tranquility and could evoke evil. Black is also an effective color, similar to white, that could reflect every desire or fear. When used on small surfaces, black creates vitality and a feeling of anxiety and fear when used on large surfaces. It reminds people of troubles and worries, but it is also true that we wear black dresses in joyful times and for special occasions. In this case, black is an indicator of personality. Although the true black color does not exist in nature, the flowers, leaves or shoots on plants look like black. This perceived black is actually a variation of red or purple. For example, the very popular black tulip *Tulipa* "Queen of Night" or *Tulipa nigra* "Barlaensis" is actually dark purple, and *Ranunculus ficaria* "Bronze Hassy" is dark bronze. Black plants create a dramatic effect in the landscape and attract the gaze due to the power of black. When combined with whites, the effect of both colors increases. Thus, the drama of a white composition increases with the dark color or shade effect created by black. For example, when *Alcea rosea* 'Nigra' or *Alcea rosea* 'Black Beauty' is used with white-flowered perennials (*Eupotarium rugosa* or *Lysimachia clethroides*), the perception of the flower color intensifies (Gou, et.al, 2020; Mohseni et.al, 2020; Sun and Olguntürk, 2020; Aşur and Alphan, 2018; Altınçekiç, 2000; Taş, 2019; Sharpe, 1974).

Gray, the element of compromise and balance, represents humility and a dignified kindness. Gray, which lacks the dominant weight of black, psychologically evokes peace, tranquility, modesty and caution in individuals. Plants with silver and gray leaves have various surface textures that range between leather or soft waxy surfaces and fuzzy or hard hairy ones. The hairy and waxy structure of the plant reflects the sunlight to different directions, and the plant is perceived as grayish. Gray color is also the color of leaves that conjure warm and dry climates. Gray-leaved plants often require well-drained soil and are therefore difficult to grow. Several grow in hot, dry locations and like the wind. These plants are also affected by weather and temperature conditions. For example, they appear in green or blue tones in shade or in winter. Gray colors are indispensable for a designer. The neutral properties of the color, and its the harmonizing effect in compositions with extensive number of elements are among the important advantages of gray. Gray color contrast with dark plants and highlight the plant groups that include gray plants due to their reflective and light-absorbing properties. Gray colored plants such as *Stachys byzantina, Veronica incana, Artemissia* 'Silver Mound', *Artemissia* 'Silver King', *Anaphalis margaritacea*, and *Anaphalis triplinerus* create nice contrasts behind dark green, bright leafy plants and colorful flower arrangements. Gray also acts as a bridge by providing neutral transitions between striking colors and textures.

Pink is a warm and nice shade of red, and evokes friendliness, youth, freshness and emotions. Pink is a prevalent flower color. It is used as a binder between strong colors. It allows successful compositions especially in locations with cloud cover and soft light. It adds vitality to shady spaces, similar to other pastel colors. Although pink is perceived like a simple color that includes white and red, the compositions that include pink are quite complex. However, independent of the shade, pink always allows the perception of red in a composition. Pink turns into peach color when combined with yellow. Thus, peach includes red and yellow or white tones. Saturated peaches create luminous and bright spaces and create effective contrasts with dark plants. Pink flowering plants include *Spirea bumalda, Veigela coreensis*, and *Lagerstromia indica*.

Variegated plants vary in color in the form of stripes, spots, or patches in yellow to yellow-green, bluish-green or white. The most visually important function of variegated plants, the leaves of which play a dramatic role in plant compositions, is their power to focus the attention and create an emphasis in landscape design. Yellow variegated plants are important design elements that would allow the addition of yellow to the space. The golden variegated plants are especially effective in high altitudes with little light in winter, and most preserve their color until the leaves fall. Yellow variegated leaves create clear, bright, luminous effects and could be combined with contrast colors or other warm colors. Plants with purple and yellow leaves could be combined for visual excitement. Since variegated plants are neutral, they can be combined with plants of several colors and textures. The variegated white offers cool effects in design and is harmonious with cold colors. Creating strong contrasts with red and orange plants, white variegated plants are best combined with plants with blue, purple and pink flowers. These plants reflect light, lighten shaded areas and especially the dark and shady corners. The inclusion of several species with variegated leaves in design could lead to powerful effects. Sometimes they could be quite ornamental. Although variegated plants create attractive points or emphasis, sometimes plants may look diseased in yellow variegated compositions. On the other hand, pure golden yellow leaves look healthier in the composition and improve the power of the design with their attractive and lively presentation. Effective color combinations could be achieved with yellow and golden variegated foliage and dark varieties. The plants with variegated leaves include *Eounymus japonica Aurea variegata, Pittosporum tobira Variegata, Hyrdrangea macrophylla variegata, tradescantia nanouk, Ilex aquifolium* and *Aurea variegata*. Based on the above-mentioned information, the color association perceptions of individuals in landscape design are presented in Table 1.

Table 1
The color association perceptions of individuals in landscape design

Red	**Passion**	**Raises blood**	**Hot**
	Love	**Pressure**	**Aggressive**
	Strength	**Raises heart rate**	**Danger**
	Anger	**Stimulates appetite**	**Stop**
Orange	Happy	Encourages	Movement
	Energetic	Movement	Provides energy
	Pleasant	Vigor	Social
Yellow	Warm	Poor skin	Lively
	Cheerful	Reflection	Secure
	Solitary	Bright	Caution
	İrritable	reflective	Slow
Green	Friendly	Concentration	Envy
	Calming	Focus	Avarice
	Neutral	Attention	Balanced
Blue	İsoloted	Lowers blood	Calm
	Peaceful	Pressure	Conservative
	Cool	Decreases appetite	Loyal
	Distant		Trusting
Purple	Spiritual	Calming	Surprise
	Enlightened	Relaxing	Magic
	Creative	Helps	Regal
	Artistic	İnsomnia	Royal
			Rare
White	Innocence	Spaciousness	Romance
	Favor	Intelligence	Order
	Dignity	Cleaning	

Red	**Passion** **Love** **Strength** **Anger**	**Raises blood** **Pressure** **Raises heart rate** **Stimulates appetite**	**Hot** **Aggressive** **Danger** **Stop**
Black	Evil Weight	Loneliness Tranquility	Seriousness Trouble Worry Fear
Variegated	Power Emphasis	Coolness Dramatic Inviting	Take Attention Excitement
Pink	Hot Alive	Cute Youth	Friendly Freshness
Gray-Silvery	Softness Serenity Balance	Calm Harmony Tranquility	Be Cautious Show Humility Humility

The present study aimed to determine the agreement levels with color associations in landscape design. The following research problems were determined:

- What are the agreement levels of open green space occupants and landscape architects with color associations in landscape design?
- Is there a difference between the agreement levels of these two groups?
- Between which associations are there differences?

2. Material And Method

2.1. The Study Sample

The research was conducted in two stages. In the first stage, a pilot scheme was conducted with a group of experts (N = 200). Based on the analysis of the pilot scheme data, the survey form was finalized. The expert group included landscape architects (N = 200). In the second stage, the survey was applied to the open green space occupants in Afyonkarahisar province (N = 400) and the same expert group (N = 200). In other words, a survey was conducted with 200 participants in the first stage and 400 individuals in the second stage.

2.2. The Study Area

The final survey was conducted in Veysel Eroğlu Park, one of the open green spaces in central Selçuklu district in Afyonkarahisar province.

The Veysel Eroğlu Park covers 55000 square meters across the Kocatepe century cemetery on Afyon-Izmir highway. The total indoor space is 845 square meters. Indoor spaces include a cafeteria and a library. This space was surrounded by an 850 square meter ornamental pool. The cafeteria has a 1000-square meter outdoor dining area.

40700 saplings and ornamental plants and 120 tall trees were transplanted in the park. The park includes 3600 square meters tartan walking path, children's playgrounds, outdoor sports field, basketball court, astro turf, foot volleyball court, foot tennis court, foot billiard field, foot soccer field, bowling field, adventure track, mini golf courses, and cable car promenades. In addition, there are seating areas, a pergola, and picnic areas. The landscape design includes the following species: *Abies nordmanninana, Aesculus hippocastanum, Acer platanoides crimson king, Betula litwinowii, Berberis thunbergii 'Atropurpurea Nana', Buxus sempervirens, Carpinus orientalis, Catalpa bignonoides, Cedrus libani, Cotoneaster frigidus 'Cornubia', Euonymus japonica, Euonymus japonica 'Aurea', Juglans regia, Juniperus horizantalis, Juniperus virginniana, Koelreuteria paniculata, Lavandula officinalis, Liquidambar orientalis ,Ligustrum japonicum, Quercus brantii, Ostrya carpinifolia, Picea orientalis, Picea pungens, Picea pungens glauca*, *Pinus nigra Arnold, Pinus sylvestris, Pinus brutia, Platanus orientalis, Platycladus orientalis, Pyracantha coccinea Roem., Prunus cerasifera 'Pissardii Nigra', Prunus avium, Prunus ceracifera 'Atropurpurea', Populus euphratica, Populus alba, Populus tremula, Robinia pseudoacacia, Rosa sp., Morus nigra 'Pendula', Salix fragilis, Salix alba, Salix matsudana, Salix excelsa, Salix babylonica, Spiraea bumalda Burv., Sophora japonica, Syringa vulgaris, Tilia platyphyllos, Thujo occidentalis, vinca major L., Brassica oleracea acephala*, and *Primula sp.* The landscape design is quite colorful for the occupants.

2.3. The development of the survey form

The study was conducted with two survey forms. The pilot survey form was applied to an expert group (Table 3). This form was employed to develop the final survey form in the study. In the pilot scheme, the 102-item Likert-type form that included color associations (red, orange, yellow, green, blue, purple, pink, white, black, gray, variegated) in landscape design were applied to the expert group. Factor analysis was conducted on the associations indicated by the experts and conceptual sub-factors were determined based on the associated variable groups. Thus, 68 items with a factor load of less than 0.20 were excluded, and the scale was reduced to 34 items. The 34 items in 3 factor group explained 52.079% of the total variance.

Table 3. The associations in the pilot survey form

Color	Code	
The RED color in landscape design that associates me,	R1	'passion'.
	R2	'love'.
	R3	' Strength'.
	R4	' anger'.
	R5	' raises blood'.
	R6	' pressure'
	R7	' Aggressive
	R8	' danger'.
	R9	' stop'
The ORANGE color in landscape design that associates me,	O1	,'happy'
	O2	, 'energetic'
	O3	'pleasant'
	O4	'social'
	O5	'encourage'
	O6	'movement'
	O7	'provides energy'
	O8	'vigor'
	O9	'eating food'
The YELLOW in landscape design that associates me,	Y1	'warm'
	Y2	'Cheerful'
	Y3	'loneliness'
	Y4	'irritable'
	Y5	'powerless'
	Y6	'Reflection'
	Y7	'bright'
	Y8	'lively'
	Y9	'feeling safe'
	Y10	'being careful'

	Y11	‘slowness’
The Green in landscape design that associates me,	G1	‘friendly’
	G2	‘calming’
	G3	‘neutral’
	G4	‘balanced’
	G5	‘concentration’
	G6	, ‘focusing’
	G7	‘attention’
	G8	, ‘jealousy’
	G9	, ‘ambition’
	G10	,‘corkiness’
	G11	‘healthful
	G12	‘environmental awareness’.
Blue	B1	'separation'
	B2	'serenity'.
	B3	'beatiful'
	B4	'distance'
	B5	‘lowering blood pressure’.
	B6	‘reduce pressure’.
	B7	‘reduce appetite’
	B8	‘keep calm’
	B9	‘passive’
	B10	‘being conservative’.
	B11	‘being loyal’
	B12	‘feeling safe’
Purple	P1	‘prestige’
	P2	‘aydınlanmış’
	P3	‘creative’.
	P4	‘ethereally’.

	P5	‘calmness’
	P6	‘relax’
	P7	‘help’
	P8	‘insomnia’
	P9	‘surprıse’
	P10	‘the magic’
	P11	‘fabulous’
	P12	‘rare/rarity’.
White	W1	‘innocence’
	W2	‘favor’
	W3	‘nobleness’
	W4	‘spaciousness’
	W5	‘intelligence’
	W6	‘cleanliness’
	W7	‘tidiness’
	W8	‘romantic’
Black	BL1	‘evil’
	BL2	‘slowness’
	BL3	‘loneliness’
	BL4	‘tranquility’
	BL5	‘seriousness’
	BL6	‘heartbroken’
	BL7	‘worry and fear’
Variagted	V1	‘power’
	V2	‘emphasis’
	V3	‘excitement’
	V4	‘coolness’
	V5	‘dramatic’
	V6	‘inviting’

	V7	‘striking’
Pink	PK1	‘warmth’
	PK2	‘alive’
	PK3	‘cute’
	PK4	‘youth’
	PK5	‘freshness’
	PK6	‘friendly’
Gray-silverly	GS1	‘serenity’
	GS2	‘balanced’
	GS3	‘quietness’
	GS4	‘calmness’
	GS5	‘harmony’
	GS6	‘softness’
	GS7	‘leery’
	GS8	‘humility’
	GS9	‘humble’

The pilot scheme demonstrated that the first factor group was named the physical associations since these were consistent with physical and behavioral associations reported in the literature. This factor explained 26.877% of the total variance and included 14 items. The reliability coefficient was 0.104.

The items in the second factor group were consistent with the emotional associations reported in the literature; thus, the group was named emotional associations. The factor included 9 items. This factor group explained 13.320% of the total variance and the reliability was 0.618.

The items in the 3rd factor group were consistent with the behavioral associations reported in the literature; thus, the group was named behavioral associations. It included 11 items and explained 11.882% of the total variance and the reliability coefficient was 0.765. Participant demographics in the final survey are age, gender, marital status, education status, profession and income status The survey form was finalized based on these findings (Table 5). Thus, the final survey form included 4 parts. Part 1 included questions on participant demographics. Part 2 included items that reflected physical color associations, Part 3 included items that reflected emotional color associations, and Part 4 included items that reflected behavioral color associations. Thus, the final survey form included the following item groups:

Section 1: Participant demographics

Section 2: Physical color associations

Section 3: Emotional color associations

Section 4: Behavioral color associations

Table 4
Physical, emotional, and behavioral color associations in the final survey

Factor group	Code	Connotation	Expression
1. Factor Group Physical	B1	B	Landscape design in blue that associates me of the 'separation'
	B11	B	Landscape design in blue that associates me of the ‘being loyal’
	G9	B	The green color in landscape design that associates me, ‘ambition’
	P12	P	Landscape design in purple that associates me of the ‘rare/rarity’.
	W3	P	Landscape design in white that associates me of the ‘nobleness’
	W6	P	Landscape design in white that associates me of the ‘cleanliness’
	GS2	P	Landscape design in gray-silvery that associates me of the ‘balanced’
	GS5	P	Landscape design in gray-silvery that associates me of the ‘harmony’
	GS6	P	Landscape design in gray-silvery that associates me of the ‘softness’
	BL3	E	Landscape design in black that associates me of the ‘loneliness’
	BL4	P	Landscape design in black that associates me of the ‘tranquility’
	BL6	B	Landscape design in black that associates me of the ‘heartbroken’
	BL7	E	Landscape design in black that associates me of the ‘worry and fear’
	PK6	B	Landscape design in pink that associates me of the ‘friendly’
B; Behavioral color associations (5 item), P; Physical color associations (7 item), E; Emotional color associations (3 item)			
2.Factor Emotional	GS3	P	Landscape design in gray-silvery that associates me of the ‘quietness’
	GS4	B	Landscape design in gray-silvery that associates me of the ‘calmness’
	P4	E	Landscape design in purple that associates me of the ‘ethereally’.

Factor group	Code	Connotation	Expression
	Y5	B	The yellow color in landscape design that associates me, ‘powerless’
	O2	E	Landscape design in blue that associates me of the 'serenity'.
	O1	E	The orange color in landscape design that associates me, 'happy’
	O3	E	The orange color in landscape design that associates me, 'pleasant’
	V6	B	Landscape design in variageted that associates me of the ‘inviting’
	R5	P	The red color in landscape design that associates me, ' raises blood’.
B; Behavioral color associations (3 İtem), P; Physical color associations (2 item), E; Emotional color associations (4 item)			
3. Factor behavioral	R9	B	The red color in landscape design that associates me, ' stop’
	W7	B	Landscape design in white that associates me of the ‘tidiness’
	W8	B	Landscape design in white that associates me of the ‘romantic’
	G1	B	The green color in landscape design that associates me, ‘friendly’
	G2	P	The green color in landscape design that associates me, ‘calming’
	G6	B	The green color in landscape design that associates me, ‘focusing’
	B8	B	The green color in landscape design that associates me, ‘jealousy’
	B4	P	Landscape design in blue that associates me of the 'distance'
	PK1	P	Landscape design in pink that associates me of the ‘warmth’
	O2	B	The orange color in landscape design that associates me, 'energetic’
	O4	B	The orange color in landscape design that associates me, 'social’
B; Behavioral color associations (8 item), P; Physical color associations (3 item), E; Emotional color associations (0 item)			

Based on the factor analysis, physical color associations in the 1st factor group according to the experts included rarity, nobility, cleanliness, balance, harmony, softness, tranquility. The emotional color associations in the second factor group included divinity, peace, happiness, and joy. Behavioral color associations in the 3rd factor group included stopping, organization, romanticism, friendliness, focus, jealousy, energy, and socialization.

2.4. Evaluation

The participants the participants were asked to respond the questions on a Likert scale. The questions were scored with a 5-point Likert scale (1= “exactly disagree” and 5= “exactly agree”). The scale intervals were calculated with “a = series width / number of target groups” formula and options and associated intervals are ‘Exactly Disagree’ (1,00-1,79), Disagree (1,80-2,59), Partially agree (2,60-3,39), Agree (3,40-4,19), Exactly Agree (4,20-5,00) (Table 5).

Table 5
Limits included in the evaluation of the data of the measurement tool

Value	Option	limitations
1	Exactly Disagree	1,00-1,79
2	Disagree	1,80-2,59
3	Partially agree	2,60-3,39
4	Agree	3,40-4,19
5	Exactly Agree	4,20-5,00

3. Findings

3.1. Participant and expert group demographics

Participant demographics are presented in Table 6.

Table 6
Participant demographics

		Expert	User
Gender	Female	113	79
	Male	87	121
Age	18-25	78	65
	26-35	84	78
	36-50	34	33
	50 and older	4	22
Marital status	Married	50	94
	Single	150	106

3.1.1. Physical Color Associations

The final survey form was applied to open green space occupants and experts (landscape architects) and the agreement levels of these two groups with the physical color associations were determined (Table 7). Thus, the agreement level of the occupants with the B1 association (blue reminds me of separation in landscape design) was partial (2.78) and that of the experts was at “I agree” (3.55). Similarly, the agreement level of the occupants with the B11 association (blue reminds me of loyalty was disagreement (2.255) and that of the expert group was partial agreement (3.225). The agreement level of the occupants with the G9 association (green reminds me of ambition in landscape design) was partial agreement (3.175), and that of the expert group was partial agreement (2.635). The agreement level of the occupants with the P12 association (purple reminds me of rarity in landscape design) was disagreement (2.335), and that of the expert group was also disagreement (2.405). The agreement level of the occupants with the W3 association (white reminds me of nobility in landscape design) was partial agreement (2.705), and that of the expert group was also partial agreement (2.89). The agreement level of the occupants with the W6 association was partial agreement (2.885), and that of the expert group was agreement (3.45). The agreement level of the occupants with the G2 association was partial agreement (2.74) and that of the expert group was partial agreement (2.825). The agreement level of the occupants with the GS5 association was disagreement (2.395), and that of the expert group was partial agreement (3.125). The agreement level of the occupants with the GS6 association was partial agreement (3.24) and that of the expert group was a partial agreement (3.18). The agreement level of the occupants with the BL3 association was partial agreement (2.625), and that of the expert group was partial agreement (2.54). The agreement level of the occupants with the BL4 association was disagreement (2.4), and that of the expert group was partial agreement (3.19). The agreement level of the occupants with the BL7 association was partial agreement (3.285), and that of the expert group was partial agreement (3.2825). The agreement level of the occupants with the BL6 association was partial

agreement (3.365), and that of the expert group was agreement (3.47). The agreement level of the occupants with the PK6 association was agreement (3.46), and that of the expert group was partial agreement (3.395).

Table 7
Agreement with the Associations

		N	Mean	Std. Deviation	Std. Error
B1	User	200	2,7800	1,20368	,08511
	Expert	200	3,5500	1,22269	,08646
	Total	400	3,1650	1,27154	,06358
B11	User	200	2,2550	1,12976	,07989
	Expert	200	3,2250	1,25389	,08866
	Total	400	2,7400	1,28707	,06435
G9	User	200	3,1750	1,37617	,09731
	Expert	200	2,6350	1,37887	,09750
	Total	400	2,9050	1,40210	,07011
P12	User	200	2,3350	1,09488	,07742
	Expert	200	2,4050	1,18236	,08361
	Total	400	2,3700	1,13857	,05693
W3	User	200	2,7050	1,47269	,10413
	Expert	200	2,8900	1,38473	,09792
	Total	400	2,7975	1,43060	,07153
W6	User	200	2,8850	1,33442	,09436
	Expert	200	3,4500	1,23088	,08704
	Total	400	3,1675	1,31292	,06565
GS2	User	200	2,7400	1,38637	,09803
	Expert	200	2,8250	1,37617	,09731
	Total	400	2,7825	1,38020	,06901
GS5	User	200	2,3950	1,33337	,09428
	Expert	200	3,1250	1,32974	,09403
	Total	400	2,7600	1,37919	,06896
GS6	User	200	3,2400	1,36076	,09622
	Expert	200	3,1800	1,37003	,09688
	Total	400	3,2100	1,36402	,06820

BL3	User	200	2,6250	1,17955	,08341
	Expert	200	2,5400	1,15110	,08139
	Total	400	2,5825	1,16473	,05824
BL4	User	200	2,4000	1,25213	,08854
	Expert	200	3,1900	1,10908	,07842
	Total	400	2,7950	1,24573	,06229
BL7	User	200	3,2800	1,13492	,08025
	Expert	200	3,2850	1,12253	,07937
	Total	400	3,2825	1,12733	,05637
BL6	User	200	3,3650	1,02324	,07235
	Expert	200	3,4700	,90731	,06416
	Total	400	3,4175	,96723	,04836
PK6	User	200	3,4600	1,31034	,09265
	Expert	200	3,3950	1,31820	,09321
	Total	400	3,4275	1,31303	,06565

Arithmetic mean, standard deviation and standard error for all physical associations in the survey are presented in Table 7, and the findings on the agreement levels of both groups for each association are presented in Table 8. Thus, the analysis of the difference between the agreement levels with the physical color associations in both groups revealed that there was a difference between the agreement levels with B1, B11, G9, W6, GS5, BL4 associations ($p < 0.05$). The review of the F values demonstrated that the highest difference was in B11 association, followed by BL4 and B1.

Table 8
ANOVA Results

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
B1	Between Groups	59,290	1	59,290	40,281	,000
	Within Groups	585,820	398	1,472		
	Total	645,110	399			
B11	Between Groups	94,090	1	94,090	66,061	,000
	Within Groups	566,870	398	1,424		
	Total	660,960	399			
G9	Between Groups	29,160	1	29,160	15,367	,000
	Within Groups	755,230	398	1,898		
	Total	784,390	399			
P12	Between Groups	,490	1	,490	,377	,539
	Within Groups	516,750	398	1,298		
	Total	517,240	399			
W3	Between Groups	3,423	1	3,423	1,675	,196
	Within Groups	813,175	398	2,043		
	Total	816,598	399			
W6	Between Groups	31,923	1	31,923	19,372	,000
	Within Groups	655,855	398	1,648		
	Total	687,777	399			
GS2	Between Groups	,722	1	,722	,379	,539
	Within Groups	759,355	398	1,908		
	Total	760,077	399			
GS5	Between Groups	53,290	1	53,290	30,056	,000
	Within Groups	705,670	398	1,773		
	Total	758,960	399			
GS6	Between Groups	,360	1	,360	,193	,661
	Within Groups	742,000	398	1,864		

ANOVA						
	Total	742,360	399			
BL3	Between Groups	,722	1	,722	,532	,466
	Within Groups	540,555	398	1,358		
	Total	541,278	399			
BL4	Between Groups	62,410	1	62,410	44,612	,000
	Within Groups	556,780	398	1,399		
	Total	619,190	399			
BL7	Between Groups	,003	1	,003	,002	,965
	Within Groups	507,075	398	1,274		
	Total	507,077	399			
BL6	Between Groups	1,102	1	1,102	1,179	,278
	Within Groups	372,175	398	,935		
	Total	373,278	399			
PK6	Between Groups	,422	1	,422	,245	,621
	Within Groups	687,475	398	1,727		
	Total	687,898	399			

3.1.2. Emotional Color Associations

Each emotional association item was analyzed individually, and the agreement levels of both groups with these associations were determined (Table 9). The agreement level of the occupants with the GS3 association was partial agreement (3.14), and that of the expert group was disagreement (2.58). The agreement level of the occupants with the GS4 association was partially agreement (3.245), and that of the expert group was partial agreement (2.75). The agreement level of the occupants with the P4 association was partial agreement (2.985) and that of the expert group was disagreement (2.54). The agreement level of the occupants with the Y5 association was partial agreement (2.94), and that of the expert group was partially agreement (2.755). The agreement level of the occupants with the B2 association was partial agreement (2.94), and that of the expert group was partial agreement (2.755). The agreement level of the occupants with the O1 association was agreement (3.495), and that of the expert group was partial agreement (3.135). The agreement level of the occupants with the O3 association was agreement (3.475), and that of the expert group was partial agreement (2.945). The agreement level of the occupants with the V6 association was partial agreement (3.265), and that of the

expert group was partial agreement (2.84). The agreement level of the occupants with the R5 association was partial agreement (3.38), and that of the expert group was agreement (3.465).

Table 9
Agreement with the Associations

		N	Mean	Std. Deviation	Std. Error
GS3	User	200	3,1400	1,39287	,09849
	Expert	200	2,5800	1,33134	,09414
	Total	400	2,8600	1,38933	,06947
GS4	User	200	3,2450	1,38004	,09758
	Expert	200	2,7500	1,39183	,09842
	Total	400	2,9975	1,40621	,07031
P4	User	200	2,9850	1,20917	,08550
	Expert	200	2,5400	1,18126	,08353
	Total	400	2,7625	1,21441	,06072
Y5	User	200	2,9400	1,14585	,08102
	Expert	200	2,7550	1,17980	,08342
	Total	400	2,8475	1,16518	,05826
B2	User	200	3,6700	1,22006	,08627
	Expert	200	3,3000	1,32998	,09404
	Total	400	3,4850	1,28799	,06440
O1	User	200	3,4950	1,17767	,08327
	Expert	200	3,1350	1,27865	,09041
	Total	400	3,3150	1,24082	,06204
O3	User	200	3,4750	1,27179	,08993
	Expert	200	2,9450	1,36797	,09673
	Total	400	3,2100	1,34552	,06728
V6	User	200	3,2650	1,16687	,08251
	Expert	200	2,8400	1,21730	,08608
	Total	400	3,0525	1,20971	,06049
R5	User	200	3,3800	1,07301	,07587
	Expert	200	3,4650	1,09763	,07761
	Total	400	3,4225	1,08487	,05424

Arithmetic mean, standard deviation and standard error for all emotional associations in the survey are presented in Table 10, and the findings on the agreement levels of both groups for each association are presented in Table 11. Thus, the analysis of the difference between the agreement levels with the emotional color associations in both groups revealed that there was a difference between the agreement levels with G3, G4, P4, M2, T1, T3, A6 associations ($p < 0.05$). The review of the F values demonstrated that the highest difference was in G3 association, followed by T3 and P4.

Table 10
ANOVA Results

Anova

		Sum Of Squares	Df	Mean Square	F	Sig.
GS3	Between Groups	31,360	1	31,360	16,894	,000
	Within Groups	738,800	398	1,856		
	Total	770,160	399			
GS4	Between Groups	24,503	1	24,503	12,756	,000
	Within Groups	764,495	398	1,921		
	Total	788,998	399			
P4	Between Groups	19,802	1	19,802	13,860	,000
	Within Groups	568,635	398	1,429		
	Total	588,438	399			
Y5	Between Groups	3,423	1	3,423	2,531	,112
	Within Groups	538,275	398	1,352		
	Total	541,698	399			
B2	Between Groups	13,690	1	13,690	8,406	,004
	Within Groups	648,220	398	1,629		
	Total	661,910	399			
O1	Between Groups	12,960	1	12,960	8,578	,004
	Within Groups	601,350	398	1,511		
	Total	614,310	399			
O3	Between Groups	28,090	1	28,090	16,103	,000
	Within Groups	694,270	398	1,744		
	Total	722,360	399			
V6	Between Groups	18,063	1	18,063	12,705	,000
	Within Groups	565,835	398	1,422		
	Total	583,897	399			
R5	Between Groups	,722	1	,722	,613	,434
	Within Groups	468,875	398	1,178		

Anova			
	Total	469,598	399

3.1.3. Behavioral Color Associations

The agreement levels of the expert and occupant groups with the behavioral color associations are presented in Table 11. Thus, the agreement level of the occupants with the behavioral association R9 was agreement (3.545), and that of the expert group was partial agreement (3,285). The agreement level of the occupants with the W7 association was partial agreement (3.19), and that of the expert group was partial agreement (2.725). The agreement level of the occupants with the W8 association was partial agreement (2.785), and that od the expert group was partial agreement (2.7). The agreement level of the occupants with the G1 association was agreement (3.96), and that of the expert group was agreement (3.655). The agreement level of the occupants with the G2 was partial agreement (3.335), and that of the expert group was partial agreement (3.005). The agreement level of the occupants with the Y6 association was agreement (4.12), and that of the expert group as agreement (3.805). The agreement level of the occupants with the G8 association was agreement (3.535), and that of the expert group was partial agreement (2.84). The agreement level of the occupants with the B4 association was agreement (3.495), and that of the expert group was partial agreement (3.005). The agreement level of the occupants with the PK1 association was agreement (3.625), and that of the expert group was partial agreement (3.125). The agreement level of the occupants with the O2 association was agreement (3.615), and that of the expert group was agreement (3.58). The agreement level of the occupants with the O4 association was partial agreement (3.25), and that of the expert group was partial agreement (2.7).

Table 11
Agreement with the Associations

		N	Mean	Std. Deviation	Std. Error
R9	User	200	3,5450	1,17254	,08291
	Expert	200	3,2850	1,40486	,09934
	Total	400	3,4150	1,29884	,06494
W7	User	200	3,1900	1,57999	,11172
	Expert	200	2,7250	1,66531	,11775
	Total	400	2,9575	1,63780	,08189
W8	User	200	2,7850	1,31431	,09294
	Expert	200	2,7000	1,42130	,10050
	Total	400	2,7425	1,36780	,06839
G1	User	200	3,9600	1,18974	,08413
	Expert	200	3,6550	1,18448	,08376
	Total	400	3,8075	1,19541	,05977
G2	User	200	3,3350	1,44333	,10206
	Expert	200	3,0050	1,28969	,09119
	Total	400	3,1700	1,37689	,06884
G6	User	200	4,1200	1,09158	,07719
	Expert	200	3,8050	1,22248	,08644
	Total	400	3,9625	1,16812	,05841
G8	User	200	3,5350	1,57198	,11116
	Expert	200	2,8400	1,50189	,10620
	Total	400	3,1875	1,57434	,07872
B4	User	200	3,4950	1,48018	,10466
	Expert	200	3,0050	1,21340	,08580
	Total	400	3,2500	1,37376	,06869
PK1	User	200	3,6250	1,39070	,09834
	Expert	200	3,1250	1,34851	,09535
	Total	400	3,3750	1,39076	,06954

O2	User	200	3,6150	1,31737	,09315
	Expert	200	3,5800	1,21283	,08576
	Total	400	3,5975	1,26471	,06324
O4	User	200	3,2500	1,48273	,10484
	Expert	200	2,7000	1,29940	,09188
	Total	400	2,9750	1,41930	,07096

Arithmetic mean, standard deviation and standard error for all behavioral associations in the survey are presented in Table 11, and the findings on the agreement levels of both groups for each association are presented in Table 12. Thus, the analysis of the difference between the agreement levels with the behavioral color associations in both groups revealed that there was a difference between the agreement levels with R9, W7, G1, G2, G6, G8, B4, PK1, O4 associations ($p < 0.05$). The review of the F values demonstrated that the highest difference was in G8 association, followed by O4 and PK1.

Table 12
ANOVA Results

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
R9	Between Groups	6,760	1	6,760	4,038	,045
	Within Groups	666,350	398	1,674		
	Total	673,110	399			
W7	Between Groups	21,622	1	21,622	8,206	,004
	Within Groups	1048,655	398	2,635		
	Total	1070,278	399			
W8	Between Groups	,722	1	,722	,386	,535
	Within Groups	745,755	398	1,874		
	Total	746,478	399			
G1	Between Groups	9,303	1	9,303	6,601	,011
	Within Groups	560,875	398	1,409		
	Total	570,178	399			
G2	Between Groups	10,890	1	10,890	5,813	,016
	Within Groups	745,550	398	1,873		
	Total	756,440	399			
G6	Between Groups	9,922	1	9,922	7,388	,007
	Within Groups	534,515	398	1,343		
	Total	544,438	399			
G8	Between Groups	48,303	1	48,303	20,438	,000
	Within Groups	940,635	398	2,363		
	Total	988,937	399			
B4	Between Groups	24,010	1	24,010	13,109	,000
	Within Groups	728,990	398	1,832		
	Total	753,000	399			
PK1	Between Groups	25,000	1	25,000	13,324	,000
	Within Groups	746,750	398	1,876		

ANOVA						
	Total	771,750	399			
O2	Between Groups	,123	1	,123	,076	,782
	Within Groups	638,075	398	1,603		
	Total	638,198	399			
O4	Between Groups	30,250	1	30,250	15,565	,000
	Within Groups	773,500	398	1,943		
	Total	803,750	399			

After the determination of the data on associations in each factor group, one-way analysis of variance was conducted to determine whether there was a difference between the means for the 3 factor groups (Table 13).

Table 13
Factor Mean Scores

		N	Mean	Std. Deviation	Std. Error
Physical	User	200	2,8389	,33921	,02399
	Expert	200	3,0832	,33585	,02375
	Total	400	2,9611	,35861	,01793
Emotional	User	200	3,2883	,64971	,04594
	Expert	200	2,9267	,55106	,03897
	Total	400	3,1075	,62831	,03142
Behavioral	User	200	3,4959	,75208	,05318
	Expert	200	3,1295	,70679	,04998
	Total	400	3,3127	,75159	,03758

It was determined that there was a significant difference between the mean occupant and expert group scores in 3 factors (physical association, emotional association and behavioral association) at 0.05 significance level (p = 0.000) (Table 14).

Table 14
ANOVA Results

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Physical	Between Groups	5,968	1	5,968	52,379	,000
	Within Groups	45,345	398	,114		
	Total	51,312	399			
Emotional	Between Groups	13,080	1	13,080	36,044	,000
	Within Groups	144,433	398	,363		
	Total	157,513	399			
Behavioral	Between Groups	13,422	1	13,422	25,202	,000
	Within Groups	211,971	398	,533		
	Total	225,393	399			

Table 15
The Mean Sub-Factor Association Group Scores

	Associations	N	Subset For Alpha = 0.05		
			1	2	3
Tukey HSD[a,b]	Physical	400	2,9611		
	Emotional	400		3,1077	
	Behavioral	400			3,3127
	Sig.		1,000	1,000	1,000

The direction and significance of the correlations between the factors were determined with the correlation analysis, and the effects of the factors on others were determined with multiple regression analysis (Table, 48). R^2 was calculated as .230. All variables were regressed with the standard method. The analysis was suitable for the linear model ($F = 39.510$; $p < 0.01$) and there was no autocorrelation.

Table 16
Regression Findings

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	ß Beta		
1	(Constant)	1,153	,235		4,913	,000
	1.Factor	,463	,062	,332	7,456	,000
	2.Factor	-,218	,036	-,274	-6,110	,000
	3.Factor	-,105	,030	-,157	-3,482	,001
R=,480, R2=,230 Düzeltilmiş R^2=,225, Model F= 39,510; p<0,01						

As seen in Table 17, it was statistically demonstrated that there was a significant positive correlation between the 1st factor and agreement level, and a significant negative correlation between the 2nd and 3rd factors and agreement level. The factors that explained the increase in the agreement level the most were the 1st factor (ß =, 332; p = 0.000), 2nd factor (ß = -, 274; p = 0.000), and 3rd factor (ß = -, 157; p = 0.001), respectively.

4. Conclusion

In the study, initially, all associations determined in the literature review were reduced and categorized with the adequate statistical tests and expert assessment. Thus, the colors associations that were used in the study were determined. The determined color associations were classified as physical associations, emotional associations, and and behavioral associations in 3 factors with the atatistical analysis. The following physical associations were determined: The color blue was associated with separation and loyalty. Green was associated with ambition. Purple was associated with rarity, white was associated with nobility, and cleanliness. Gray-silver was associated with balance, harmony and softness. Black was associated with loneliness, tranquility, worry, anxiety and fear. And finally, pink was associated with friendliness. Similarly, the emotional color associations determined in the study were as follows: Gray-silver was associated with calmness. The purple color was associated with divinity, yellow was associated with weakness, blue was associated with peace, orange was associated with happiness and joy, the variegated colors were associated with tempting, and finally the red color was associated with higher blood pressure. The colors in the 3rd factor group, which predominantly included behavioral associations, included red that was associated with stopping, white that was associated with orderliness and romanticism, and green that was associated with friendliness, silence, focus, and jealousy. Other colors included blue that was associated with distance, pink that was associated with warmth, orange that was associated with energy and socialization.

The agreement levels of the participants with these associations in the three factor groups were partial (2.60-3.39). A significant difference was determined between the agreement levels of both groups with

these associations (P = 0.05). It was suggested that the difference was due to socio-demographic differences and the perceptions of the occupant and expert groups.

In a study on cultural associations of plants, Güneroğlu et al. (2018) focused on plant colors and their cultural associations. In the study, the plant associations in Japanese, Indian and Turkish cultures were investigated (Güneroğlu et al., 2018). Aslan et al. (2015) reported that humans are in constant interaction with their spaces and they perceive space through the senses. They emphasized that perception constitutes a large part of visual perception based on the visual sense, and the concepts of form, color, material, texture and light are design elements that affect the visual perception of the space. They also stated that color contributes to spatial perception through the expression of the spatial functions (Arslan et al., 2015). In a study titled “Analysis of Color Impact in Planting Design: A Case Study of Ankara Milli Egemenlik Park,” Çorbacı et al. (2018) claimed that “in landscape architecture projects, color is important not only for planting designs but also for non-living objects and structural designs (water, soil, accessory elements, etc.). The examination of the success and failure of the existing green areas with structural and herbal designs after use will shed light on the correct use of colors in landscape design.” Furthermore they stated that “landscape architects will have a direct influence on the psychology of the users of the space by choosing the plant taxon which can show the correct color that will complement the design, the correct timing, quantity, and density of the plant to show that color. In this context, opportunities will be provided within the scope of this study through the mentioned methods allowing the projects to be analyzed and evaluated in terms of color usage, before being applied.”

Declarations

Ethical Approval: Not applicable.

Consate to participate: Not applicable.

Consent to Publish: Not applicable.

Author contribution Conceptualization: E.T.E,E.M.A, T.D.

- Methodology: E.T.E., T.D..
- Data curation: E.M.A.
- Formal analysis: E.T.E,E.M.A
- Writing—original draft: E.T.E
- Writing—review and editing: E.T.E,E.M.A.,T.D.

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Tables

Table 2 is available in the Supplementary Files section.

Supplementary Files

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- Table2.docx