A Method Proposal for the Evaluation of Spatial Perception and Emotional State in the Context of Interior Design Variables and Stage Lighting

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ABSTRACT
Perception of space basically occurs with visual perception, but visual perception is not the only thing that creates or affects the interior space perception. Emotional state created by the interior also affects the interior space perception as integrated with visual perception. Also, flexibility in design is one of the significant notions that is stand out in design field. Flexibility in design, can be provided by changing the interior space perception but also to provide comfort in flexible interiors visual perception of different usage scenarios in the flexible interiors should be examined. To examine the integrated interior space perception, both spatial perception and emotional state criteria should be examined. Therefore, in the context of this research, a case study is conducted, to offer a methodology to evaluate the "spatial perception" and "emotional state" in interiors. Theatre stage selected as the experiment area and the light is selected as the design variable because of their power to change instantly. As a result, this study offers a method for the evaluation of the "spatial perception" and "emotional state" in the context of design variables and stage lighting.
Keywords: Spatial Perception, Emotional State, Interior Design, Lighting, Theatre Stage.

1. INTRODUCTION
The fundamental perception of interior architecture primarily arises from visual perception, yet every space generates not only spatial but also emotional perception among those who experience it. Variables such as the relationships among three-dimensional elements, surface-material selection, and lighting can influence both spatial perception and emotional states. However, the principle of flexibility in interior architectural design stands out in innovative design approaches by enabling the creation of designs that respond to diverse needs, providing usability, efficiency, and sustainability. In this context, designing flexible spaces that can change and adapt is possible by applying design variables such as form, surface, material, and light in different ways. However, to efficiently utilize the principle of flexible design in interior architecture, it is necessary to measure and analyze how such variable spaces affect users' spatial perception and emotional states. Consequently, the most crucial variable capable of rapidly transforming spatial perception is the lighting design—the design of illumination. Light can instantly create, eliminate, or completely transform the image associated with a space or any object. The area where this transformative power of light can be most clearly and comfortably applied is the theater stage, where a free perception of space independent of concrete/three-dimensional elements can be created. In this study, lighting design is considered as a variable, and a case study is planned. The theater stage is chosen as an experimental space where different lighting scenarios can be instantly created, aiming to develop a proposed methodology for evaluating spatial perception and emotional states.

2. THEORETICAL FRAMEWORK

To propose a methodology to evaluate and measure the spatial perception and emotional state for the interiors, firstly spatial design notion should be examined. Also because of the main consideration of this methodology proposal, focuses on offering an evaluation method through stage lighting; theatre, stage design and stage lighting concepts should be examined too. In this context; spatial design, light, theatre, stage design and stage lighting concepts were examined to offer a common comprehensive theoretical framework.

2.1. Spatial Design

Architectural space can be characterized by defined boundaries and can be defined as a limited void where different activities. Architectural space; is a physical reality which has a definable shape, texture and color and where various actions take place within (Soygeniş, 2006).

Basically, interiors may seem as a simplistic, two-dimensional representation and as the composition of objects, color, light, and people. However, this simplistic representation merely serves as one aspect of what constitutes an interior space. The latent and less clear intersections of these elements and their impacts on the interior come to the forefront as a secondary layer. A genuine interior requires the designer's nuanced perspective in order to create a space that evolves from hour to hour and day to day, contingent upon the environment and actions of the individuals within the interior setting (Weinthall, 2011).

In memorable architectural experiences, the combination of space, matter, and time converges into a singular dimension, forming the fundamental essence of existence that permeates our awareness. We associate ourselves with this space, this specific place, this moment, and these dimensions become integral aspects of our existence. Architecture is the artistic process of harmonizing our identity with the world, and this connection created by sensory perception (Pallasmaa, 2008; Kuban, 2016). Kuban (2016) states that; today, humans cannot be considered independently of the environment, that there is an organic bond between the entire environment, whether natural or artificial, and the humans' life, and that humans are actually a part of a larger organism.

In this context the evaluation of spatial design will be discussed integrated with the space perception and emotional state to investigate and offer an evaluation methodology to reveal the effects of the interior design variables.

2.2. Theatre and Stage

Nutku (2002) defines the stage as a performance space that is not confined to a single structure but exists as a narrative tool even in open spaces and also it can provide unlimited narrative power by revealing the actor's universe in related to the director's creative design ideas. Although the primary consideration in stage design is the actors who will use the stage, there are three fundamental points that must be taken into account in this regard: the necessary items on the stage (set design), the actors' entrances and exits, and the balance of light and color (Nutku, 2002). In theater, narration (imitation) holds a significant place. The creation of the stage by set designers is also a form of narration, essentially an imaginative process that should have a transformative effect. No object on stage is included solely for the practical needs of the actors; the spatial arrangement of each object is crucial, and objects on stage should have the power to influence the audience independently of the actors. Additionally, each object on stage must play a role, and any object without a role on stage should not be part of the set (Brecht, 2011).

Just as the perception of a space cannot form without the presence of light, the appearance of that space changes depending on the characteristics of the light used in that environment. In fact, everything we see in a given space is the appearance revealed by the impact of the light used in that space (Dunham, 2016).

The artist on the stage, performs in a space created by light, enacting the defined actions for that space. However, when the light goes out, the space disappears (Soygeniş, 2006). From this point of view, stage lighting design also creates an alternative representation to the literary interpretation, which is the foundation of theater. In conclusion, theater, entirely brought to life and expressed by light, becomes a live performance with its own unique meaning and significance (Baugh, 2013).

2.3. Architectural Lighting and Stage Lighting

Due to the controllable features of lighting, a lighting designer can create desired effects. These controllable features include light distribution, light intensity, the movement of light, and the color of light.

In architectural lighting, "light distribution" is used to determine the light distribution provided by lighting fixtures or to assess the uniformity of light in a space, i.e., whether the light is evenly distributed throughout the entire space or not. In stage design, "light distribution" is a comprehensive design parameter that refers to the wide-ranging design aspects referencing other elements. The direction of light, the size and shape of the illuminated area, the quality of light (clarity and diffusion), and the character of light (texture) play a role, such as whether it is smooth, textured, patterned, sharp, or soft-edged. The focal points of lighting elements (the focal point in stage lighting is, the point where the lighting element is directed on stage), the emphasis area, and texture define the actors and their surroundings (Gillette & McNamara, 2014).

In architectural lighting, "Luminous intensity" specifies the light emission power in a particular direction from a point source and is defined as the density of light flux in that direction (IESNA, 2011). In stage design, "light intensity" indicates the amount of light directed towards the stage or actor in a specific direction. Dimming switches can be used to adjust light intensity. The stage can be completely darkened, or full brightness can be provided as needed. Light intensity in stage lighting can be found in both extreme situations and can be adjusted to meet the needs of the scene or moment in the play. Light intensity can be controlled in various ways, such as changing the color of light, using different power lamps, or using mechanical dimming methods such as shutters or irises that are usually controlled by dimmer switches for follow spots and moving lighting elements (Gillette & McNamara, 2014).

To explain the movement of light in stage lighting, it is necessary to first define the concept of "Light Cue”. Light Cue is an action that generally increases or decreases the light intensity of one or more lighting elements. Therefore, when there is any change in the light on the stage, a different "Light Cue" is entered. The movement of light can be considered in three general categories. The first is the duration of a Light Cue, which specifies the length of time it takes for lights to turn on or off. The second is the movement of lights on the stage, such as lanterns or candles. The third is the movement of light sources outside the stage, such as follow spots or moving lights (Gillette & McNamara, 2014).

In lighting, lights of different colors have different wavelengths, and white light is composed of a mixture of red, green, and blue light. In architectural lighting, when referring to light color, it is generally not about the direct painting color but the light color temperature of the lamps. Light color temperature is measured in K (kelvin), ranging from warm to cool. Unlike thermal temperature, as the K value increases, the light is perceived as cool (white), while as the K value decreases, the light is perceived as warm (yellow). In stage design, "light color" tools allow the designer to reach all color ranges of the rainbow. Carefully chosen and reasonably used colored lights can significantly enhance the stage. Happy, pastel colors can create a pleasant and intimate environment for a musical comedy, while a sharp white light dropped onto a black background can strengthen the sense of conflict in a play like Antigone (Gillette & McNamara, 2014).

In this context, this study aims to explore the effects of light on spatial perception and emotional states by utilizing the variability potential of stage lighting and approaching the stage as an experimental space.

3. METHOD

In the context of this study, it is aimed to offer a new methodology to evaluate the effects of interior design variables on spatial perception and emotional state. In this direction to determine the parameters to investigate, a literature review was conducted on previous relevant studies and methodologies. It has been observed that the relationship between light and space perception, theatre hall and stage lighting arrangements, the relationship between lighting and theatre hall stage form, the role of light in stage performances, and basic stage lighting requirements in multi-purpose halls have been investigated on the existing studies on lighting, stage lighting, space perception, theater and emotional state. Studies that consider the variables of illuminance level, light color temperature, brightness and contrast values of light were reviewed to examine the criteria to evaluate the spatial effects of lighting, and studies that focuses on the stage design were reviewed to examine the criteria to evaluate the emotional state.

Based on this review, the criteria to evaluate the spatial perception and emotional state was specified by not only considering the literature review but also improving it. Then a case study method which can be conducted as digitally and also consider the theatre stage as an experiment area is improved. Subsequently a sample case study is conducted to test the feasibility of the method and to examine how the light effects the spatial perception and emotional state as a sample evaluation.

3.1. Data Obtained from the Literature Review on Stage Lighting

Different studies on stage lighting reviewed from the literature, to design a sample case study through stage lighting. In the examination of the audience hall and stage lighting arrangements, the illuminance level in the audience hall and at the stage, as well as the color and directional characteristics of light, were quantitatively evaluated. Meanwhile, subjective evaluations were made on audience hall surface colors, illuminance levels, visibility of the stage, and visual comfort conditions. Then the results were evaluated and examined (Pekin, 2015). Stage lighting requirements also have been defined via the evaluation of the relationship between lighting and theatre stage form through a sample structure, and features such as illuminance level, light distribution, light color, light movement, selective visibility, adding depth and composition are examined in the context of the acting area, actors, and background lighting (Oğuzhan, 2013). In the examination of the role of light in stage performances, two performances were analyzed and interviews were conducted with the lighting designers to explore the objectives and considerations in lighting design; dancer/actor-light relation, audience-light relation, and the impact of the stage type on lighting design (Gardner, 2010). To examine the basic stage lighting requirements in multi-purpose halls; stage usage functions, stage lighting elements, lighting devices and lighting methods were examined on a sample hall. The existing situation in the hall was determined and recommendations were provided to improve the situation. Also, the lighting requirements in multi-purpose halls and the features that are required for these halls were defined (Yener, 2004).

In addition, in the study where the relationship between stage design and architectural space is examining two sample stage designs were examined. It has been shown that lighting is effective on space formation, provides identification of the boundaries of the space, creation of the sub-spaces, circulation and orientation in the space (Vidinlisan, 2010). In the study examining the effects of stage lighting on architectural lighting, stage lighting and architectural lighting were evaluated in terms of lighting techniques and lighting elements in the historical process and their interactions with each other were revealed (Özatılgan, 1994). In the study where artificial light in space design is examined; a space was created in a computer environment, different lighting conditions were simulated in this space, and through the created visuals; the effects of illuminance level, light distribution, light direction, light color and materials used in the space on the spatial perception have been revealed (Fitöz, 2002). In examining the perception of space in the context of environment-human relationship, space users; The effects of physical elements on the perception of space were revealed by asking questions about the duration of use of the spaces, the activities they performed in the space, the comfort conditions of the space, space design and space tastes (Erniş, 2012).

In current studies, it is observed that there is a relationship between spatial perception - lighting and stage lighting - architectural lighting. Therefore, theatre stages can be offered as an experiment area to evaluate the spatial perception and emotional state.

3.2. Data Obtained from the Literature Review to Evaluate Spatial Perception and Emotional State

Lindh’s (2012) study was conducted by following methodologies observed in previous studies in the field and utilizing mixed methodologies. Based on observation, interviews, and surveys, the "spatial boundary experience" was examined with regard to surface luminance, illuminated areas, and spatial boundaries. The "perception of size and depth" was explored in connection with surface luminance, vertical and horizontal light distributions, and illuminated areas. The changes in the "perceived form" were analyzed also based on illuminated areas. To evaluate the spatial boundary experience, the notions of; delimited, open, enclosed, excluding, airy, confined, alienating, close were examined. For the spatial dimensions, the notions of; small, large, square, round, shallow, deep, narrow, wide, low, high were examined. Also for the general spatial perception the following notions were evaluated; chaotic, impersonal, soft, monotonous, unpleasant, stimulating, warm, ordinary, profane, heavy, lively, unusual, pleasant, boring, hard, active, deliberating, cold, depressing, subdued, embracing, welcoming, friendly, public, harmonic, intense, bright, unclear, dynamic, deliberating, light weight, personal, calm, unfriendly, private, inviting, complex, safe, simple, rejecting, unsafe, scared, dark, legible/clear, diffuse (Lindh, 2012).

Vogels' (2008) study provides a method to measure the perceived atmosphere of a environment. Although atmosphere is defined as the emotional evaluation of the environment, it can also influence individuals' emotional states. In the scope of the study, firstly, terms used by individuals to describe the environmental atmosphere were identified to create a dictionary of atmosphere perception and from this dictionary, 38 terms were selected. An atmosphere survey was then prepared using these terms, and participants were asked to rate these terms on a scale ranging from "not at all suitable" to "very suitable" on a 7-point scale. In the experiment, terms such as coziness, liveliness, tenseness, and detachment are predominated and the study also demonstrate that the method is effective to define the spatial atmosphere (Vogels, Vries, & Thomas, 2008).

Clarke and Bradshaw (2005) conducted a study to examine the possibility of defining the emotional content of behavior through the bodily movements of actors in dialogue. For this purpose, actors were asked to perform a series of eight-sentence texts involving emotions such as sadness, anger, joy, disgust, fear, and love. During these performances, illuminated markers were placed on the actors' bodies, and recordings were taken. Then these recordings were shown to the participants without dialogues and participants asked to evaluate the emotional content of the images they watched on the screen using a horizontally adjustable scale for six emotional states provided to the actors. Also, each recording was evaluated based on all six emotions (Clarke & Bradshaw, 2005).

In their experimental study on the relationship between lighting quality, lighting arrangements, and perception, Manav and Yener (1999) prepared a room with four different lighting arrangements. For each lighting arrangement, participants' perceptions of clarity, width, comfort, privacy, satisfaction, and order were investigated. The results indicated that different lighting arrangements influenced perception. Wall washing lighting increased clarity and the perception of order, while cove lighting enhanced the perception of width and order. Up-lighting, on the other hand, contributed to a more relaxing, intimate, and pleasant perception of the same space (Manav & Yener, 1999).

Manav's (2005) study is aimed to identify the key parameters which influences the relationship between the visual perception, spatial perception, and lighting. In the scope of the study, determinative factors were defined, and an experimental setup was designed to assess the effects of illuminance level, color temperature, and luminance contrast on spatial perception through perceptual evaluations. The spatial perception notions of; spaciousness, comfort, visual clarity and contentment were evaluated (Manav, 2005).

Flynn (1979) proposed a method to measure the subjective effects of lighting based on his previous researches. The designated effects of the lighting environment were identified using semantic differential rating and multidimensional scaling. The semantic differential (SD) rating scale employed in this research method indicates user impressions related to perceptual, behavioral, and overall preferences. The findings of the study suggest that lighting can be considered as a tool that alters the content of the visual environment, and its effects can be measured. In addition, it reveals how the fact that lighting is a part of the effects of the visual space affects users' impressions of the space and their well-being. The spatial concept pairs evaluated in this study include; friendly-hostile, pleasant-unpleasant, like-dislike, harmony-discord, satisfying-frustrating, beautiful-ugly, sociable-unsociable, relaxed-tense, interesting-monotonous, clear-hazy, bright-dim, faces clear-faces obscure, distinct-vague, focused-unfocused, radiant-dull, simple-complex, uncluttered-cluttered, large-small, long-short, spacious-cramped, rounded-angular, informal-formal (Flynn, 1979).

For the emotional state assessment, Watson et al. (1988) suggest and used the “positive affect and negative affect scale” (PANAS). PANAS consists of two affect scales, each containing 10 adjectives (scales) related to the emotional state assessment. Subjects were asked to evaluate the effects of the specified lighting environment on their emotional states on a 5-point scale ranging from "too little" to "too much" according to this scale. Positive scales are; enthusiastic, interested, determined, excited, inspired, alert, active, strong, proud, attentive and negative scales are; scared, afraid, upset, distressed, jittery, nervous, ashamed, guilty, irritable, hostile (Watson et al., 1988).

In the literature review, where the studies examining the relationship between space perception and lighting; It has been observed that methods such as photometric measurement, eye tracking, observation, interview, survey and creating a dictionary of perception terms were used. Sample spaces used in the reviewed studies in the literature; are the different functioned interior spaces, outdoor spaces, private interior spaces, specifically designed spaces to create different lighting conditions.

3.3. Case Study for the Evaluation of Spatial Perception and Emotional State Method Proposal in the Context of Interior Design Variables and Stage Lighting

To propose a method to evaluate the spatial perception and emotional state in the context of interior design variables, it is decided to use the theatre stage as an experiment area. For this case study, lighting is selected as a sample variable of interior design because of its’ powerful transformative effects and applicability on stage. Since the variable is selected as light, the all other components of the stage design selected as basic components to represent an ordinary interior. The selected set design consists; white background (floor and vertical panels), a basic sofa, an ordinary carpet and a basic pendant. Depending on the literature review, lighting variables specified as, light direction (general-top, front, back and sides), light amount by dimming (%100, %75, %50, %25), light color temperature (5200K, 4200K, 3200K), and visible light color (white, red and blue). With these variables a number of different scenarios generated on the theatre stage and photographs of these scenarios were taken from the same point of view. Plan view representations of the generated scenarios given in Figure 1.

Figure 1. Plan view representations of the generated scenarios for the light variables.

In order to evaluate the perception of space, spatial perception notion pairs that are opposite to each other (negative - positive spatial perception notions) were determined based on the literature review and expanded as; dark-bright, narrow-wide, flat-spacious, cold-hot, complex-clear, monotonous-dynamic, ordinary-intriguing, dangerous-safe, tedious-entertaining, repulsive-inviting, ugly-pleasant. Also to evaluate the human psychology, the notions describe to emotional state were also determined based on the literature review and expanded as; peace, joy, happiness, love, hate, sadness, distress, fear. For the evaluation of spatial perception notion pairs; "1" represents the negative spatial perception notions and "5" represents the positive spatial perception notions. For the evaluation of emotional state notions; "1" represents that there is no effect of that notion and "5" represents that there is a high effect of that notion on the viewed scene.

100 participants aged between 18-45 who do not have any visual impairments attended to the study, to evaluate the scenarios spatial perception and emotional state. The %20 of the participants attend the study by using the same computer screen and the rest, %80 of the participants, attended to the study by using their own individual screens.

4. RESULTS

The results of the differences between the spatial perception parameters and emotional states, and different light variables were evaluated with Pearson Correlation Test. The comparison of the results depending on the participants' screen usage type (same computer screen and individual screens) evaluated with Independent Sample T Test. Also, the comparison of the results depending on the participants age were evaluated with One Way ANOVA Test and Post Hoc Tests.

4.1. Effects of the Light Variables on the Spatial Perception Notions

The results of the effects of the light variables on the spatial perception notions were represented in the Table 1.

Table 1. Examining the Relationship Between Light Direction, Light Amount, Light Color Temperature and Light Color Configurations and Spatial Perception

Spatial Perception Notions	Coeff.	General Top	Front	Back	Sides	Light Amount	Light Color Temp.	White	Red	Blue
Dark-Bright	r	,080**	-,069*	-,087**	,093**	,352**	,071*	,582**	-,143**	-,293**
	p	0,008	0,021	0,004	0,002	0	0,018	0	0	0
Narrow-Wide	r	0,059	-0,05	-,143**	,155**	,257**	0,05	,509**	-,094*	-,283**
	p	0,05	0,094	0	0	0	0,099	0	0,013	0
Confined-Spacious	r	0,026	-0,055	-,082**	,123**	,230**	0,021	,561**	-,150**	-,287**
	p	0,388	0,068	0,006	0	0	0,485	0	0	0
Cold-Warm	r	-,230**	,079**	-0,016	,089**	,211**	-,195**	,173**	,293**	-,344**
	p	0	0,009	0,589	0,003	0	0	0	0	0
Complex-Clear	r	,132**	-,107**	-0,004	-0,017	,065*	,126**	,443**	-0,001	-,233**
	p	0	0	0,893	0,568	0,032	0	0	0,974	0
Monotonous-Dynamic	r	-,175**	,086**	0,01	,069*	,165**	-,166**	,092*	,130**	-,232**
	p	0	0,004	0,73	0,022	0	0	0,015	0,001	0
Ordinary-Curious	r	-,195**	,116**	,092**	0,041	,109**	-,208**	-,131**	,217**	-,119**
	p	0	0	0,002	0,178	0	0	0,001	0	0,002
Dangerous-Safe	r	0,056	-0,015	-,072*	,065*	,161**	0,042	,343**	-,077*	-,174**
	p	0,065	0,631	0,017	0,03	0	0,168	0	0,042	0
Tedious-Entertaining	r	-,202**	,066*	,066*	0,051	,104**	-,189**	0,06	,149**	-,206**
	p	0	0,029	0,029	0,094	0,001	0	0,116	0	0
Repulsive Inviting	r	-0,058	0,041	0,033	0,041	,110**	-,077*	,223**	,081*	-,195**
	p	0,056	0,175	0,28	0,175	0	0,011	0	0,033	0
Ugly-Pleasant	r	-,066*	0,019	0,045	0,019	,111**	-,070*	,231**	0,048	-,181**
	p	0,028	0,534	0,136	0,534	0	0,02	0	0,2	0
Spatial Perception N.	r	-,075*	0,013	-0,025	,103**	,264**	-,079**	,414**	0,058	-,338**
	p	0,012	0,669	0,405	0,001	0	0,009	0	0,125	0

*p<0,05, **p<0,01, r: Pearson Correlation

A low level of positive correlation was observed between the general direction and dark-bright and complex-clear spatial notion pairs ($p<0.05$). A low level of negative correlation was observed between light direction and cold-warm, monotonous-dynamic, ordinary-curious, tedious-entertaining, ugly-pleasant and spatial perception notions ($p<0.05$). A low-level positive relationship was observed between front directed light and cold-warm, monotonous-dynamic, ordinary-curious and tedious-entertaining ($p<0.05$). A low level of negative correlation was observed between front directed light and dark-bright and complex-clear ($p<0.05$). A low level of positive correlation was observed between back direction and ordinary-curious and tedious-entertaining ($p<0.05$). A low level of negative correlation was observed between back direction and dark-bright, narrow-wide, confined-spacious and dangerous-safe ($p<0.05$). A low level of positive correlation was observed between the light directed from the sides and dark-bright, narrow-wide, confined-spacious, cold-warm, monotonous-dynamic, dangerous-safe and spatial perception ($p<0.05$).

A moderate positive correlation was observed between the light amount and dark-bright, and a low level of positive correlation was observed between other spatial perception parameters ($p<0.05$).

A low level of positive relationship was observed between light color temperature and dark-bright and complex-clear ($p<0.05$). A low level of negative correlation was observed between light color temperature and cold-warm, tedious-entertaining, repulsive-inviting, ugly-pleasant and spatial perception ($p<0.05$).

There is a moderate positive correlation between white light and dark-bright, narrow-wide, confined-spacious, complex-clear, dangerous-safe and spatial perception, and a low level of positive correlation between cold-warm, monotonous-dynamic, repulsive-inviting and ugly-pleasant was observed (p<0.05). A low level of negative correlation was observed between white light color and ordinary-curious (p<0.05). A medium level positive relationship was observed between red light and cold-hot, and a low level of positive relationship was found between cold-hot, monotonous-dynamic, ordinary-intriguing, boring-entertaining and repulsive-inviting (p<0.05). A low level of negative correlation was observed between red light and dark-bright, narrow-wide, flat-spacious and dangerous-safe (p<0.05). With blue light, dark-bright, narrow-wide, flat-spacious, mixed-clear, monotonous-dynamic, ordinary-intriguing, dangerous-safe, boring-entertaining, repulsive-inviting and ugly-pleasant, at a low level, cold-hot. A moderate negative relationship was observed between spatial perception and spatial perception (p<0.05).

4.2. Effects of the Light Variables on the Emotional State Notions

The results of the effects of the light variables on the emotional state notions were represented in the Table 2.

Table 2. Examining the Relationship Between Direction in Light Configurations, Light Amount Level, Color Temperature and Light Color and Emotional State

Emotional State Notions	Coeff.	General Top	Front	Back	Sides	Light Amount	Light Color Temp.	White	Red	Blue
Peace	r	0,007	**-,061***	-0,021	**,081****	**,126****	0,005	**,426****	**-,132****	**-,185****
	p	0,814	**0,043**	0,483	**0,007**	**0**	0,877	**0**	**0**	**0**
Joy	r	-0,023	-0,043	**-,061***	**,076***	**,106****	-0,004	**,392****	**-,101****	**-,163****
	p	0,438	0,152	**0,043**	**0,012**	**0**	0,899	**0**	**0,008**	**0**
Happiness	r	-0,006	-0,028	-0,054	**,068***	**,123****	0,002	**,421****	**-,093***	**-,167****
	p	0,855	0,36	0,075	**0,024**	**0**	0,96	**0**	**0,014**	**0**
Love	r	-0,005	-0,027	-0,048	0,046	**,100****	0,007	**,425****	**-,084***	**-,164****
	p	0,857	0,365	0,112	0,125	**0,001**	0,812	**0**	**0,026**	**0**
Hate	r	-0,049	0,032	0,027	-0,043	**-,081****	-0,036	**-,184****	**,189****	**,088***
	p	0,103	0,291	0,378	0,159	**0,007**	0,237	**0**	**0**	**0,02**
Sadness	r	-0,031	-0,026	0,018	-0,018	**-,119****	-0,009	**-,189****	**0,056**	**,119****
	p	0,297	0,387	0,554	0,543	**0**	0,754	**0**	**0,136**	**0,002**
Distress	r	-0,003	0,005	0,02	-0,048	**-,120****	0,007	**-,336****	**,142****	**,180****
	p	0,931	0,879	0,513	0,108	**0**	0,813	**0**	**0**	**0**
Fear	r	**-,083****	**,109****	0,045	**-,083****	**-,134****	**-,076***	**-,354****	**,289****	**,161****
	p	**0,006**	**0**	0,137	**0,006**	**0**	**0,011**	**0**	**0**	**0**
Positive Emotional State N.	r	-0,007	-0,043	-0,05	**,074***	**,124****	0,003	**,444****	**-,109****	**-,181****
	p	0,811	0,151	0,1	**0,014**	**0**	0,93	**0**	**0,004**	**0**
Negative Emotional State N.	r	-0,051	0,038	0,033	-0,059	**-,138****	-0,035	**-,320****	**,204****	**,165****
	p	0,09	0,209	0,269	0,051	**0**	0,24	**0**	**0**	**0**

*p<0,05, **p<0,01, r: Pearson Correlation

A low level of negative relationship was observed between general top directed light and fear (p<0.05). A low level of positive relationship was observed between front directed light and fear (p<0.05). A low level of negative relationship was observed between front directed light and peace (p<0.05). A low level of negative relationship was observed between back oriented light and joy (p<0.05). A low level of positive relationship was observed between the light directed from the sides and peace, joy, happiness and positive emotional state perception (p<0.05). A low level of negative relationship was observed between the light directed from the sides and fear (p<0.05).

A low level of positive relationship was observed between the light amount and peace, joy, happiness, love and positive mood (p<0.05). A low level of negative relationship was observed between the light amount level and hate, sadness, distress, fear and negative emotion (p<0.05). A low level of negative relationship was observed between color temperature and fear (p<0.05).

A moderate positive relationship was observed between white light color and peace, joy, happiness, love and positive mood (p<0.05). A low level of negative relationship was observed between white light color and hate and sadness, and a moderate negative relationship was found between distress, fear and negative mood (p<0.05). A low level of positive relationship was observed between red light color and hate, sadness, distress, fear and negative emotion (p<0.05). A low level of negative relationship was observed between red light color and peace, joy, happiness, love and positive mood (p<0.05). A low level of positive relationship was observed between the blue light color and hate, sadness, distress, fear and negative emotion (p<0.05). A low level of negative relationship was observed between the blue light color and peace, joy, happiness, love and positive emotional states (p<0.05).

4.3. Comparison of Participants' Spatial Perception and Emotional State Evaluations According to Screen Usage Type

To compare the participants' spatial perception and emotional state evaluations according to the screen usage type, and also to examine the reliability of the method and usage of different types of the screens, a sample comparison evaluation made for the variables of the light direction and results were represented in Table 3 and Table 4.

Table 3. Comparison of Participants' Spatial Perception Evaluations According to Screen Usage Type

Spatial Perception Notions	Screen Usage Type	N	Mean	S.D.	t	p
Dark-Bright	Individual Screen	400	3,26	1,29	1,811	0,071
	Same Screen	100	3,00	1,25		
Narrow-Wide	Individual Screen	400	3,14	1,28	0,960	0,338
	Same Screen	100	3,00	1,29		
Confined-Spacious	Individual Screen	400	2,88	1,20	1,132	0,258
	Same Screen	100	2,73	1,22		
Cold-Warm	Individual Screen	400	2,85	1,23	-0,108	0,914
	Same Screen	100	2,86	1,33		
Complex-Clear	Individual Screen	400	3,04	1,24	1,129	0,259
	Same Screen	100	2,88	1,29		
Monotonous-Dynamic	Individual Screen	400	2,76	1,19	-1,129	0,259
	Same Screen	100	2,91	1,19		
Ordinary-Curious	Individual Screen	400	2,96	1,26	-0,125	0,901
	Same Screen	100	2,98	1,24		
Dangerous-Safe	Individual Screen	400	3,02	1,18	1,101	0,272
	Same Screen	100	2,87	1,15		
Tedious-Entertaining	Individual Screen	400	2,57	1,06	-0,961	0,337
	Same Screen	100	2,68	1,12		
Repulsive-Inviting	Individual Screen	400	2,84	1,16	1,705	0,089
	Same Screen	100	2,62	1,14		
Ugly-Pleasant	Individual Screen	400	2,77	1,09	-0,041	0,967
	Same Screen	100	2,77	1,08		
Spatial Perception N.	Individual Screen	400	2,92	0,78	0,803	0,422
	Same Screen	100	2,85	0,79		

*p<0,05, **p<0,01, t: Independent Sample T Test

Spatial perception scores of the participants did not differ depending on the screen usage type (p>0.05). Therefore, the methodology can be used to evaluate the spatial perception notions via using the same screen or some other screen.

Table 4. Comparison of Participants' Emotional State Evaluations According to Screen Usage Type

Emotional State Notions	Screen Usage Type	N	Mean	S.D.	t	p
Peace	Individual Screen	400	2,41	1,14	1,173	0,241
	Same Screen	100	2,26	1,06		
Joy	Individual Screen	400	2,23	1,07	0,681	0,496
	Same Screen	100	2,15	1,13		
Happiness	Individual Screen	400	2,30	1,10	0,916	0,360
	Same Screen	100	2,18	1,20		
Love	Individual Screen	400	2,29	1,06	0,955	0,340
	Same Screen	100	2,17	1,14		
Hate	Individual Screen	400	2,31	1,20	2,012	0,045
	Same Screen	100	2,04	1,21		
Sadness	Individual Screen	400	2,52	1,21	2,018	0,044
	Same Screen	100	2,24	1,26		
Distress	Individual Screen	400	2,88	1,20	0,831	0,407
	Same Screen	100	2,76	1,50		
Fear	Individual Screen	400	2,68	1,34	3,091	**0,002****

	Same Screen	100	2,22	1,28		
Positive Emotional State N.	Individual Screen	400	2,31	1,00	1,018	0,309
	Same Screen	100	2,19	1,03		
Negative	Individual Screen	400	2,60	1,02	2,411	**0,016***
	Same Screen	100	2,32	1,11		

*p<0,05, **p<0,01, t: Independent Sample T Test

For the emotional state notions, only the fear scores differed depending on the participants' screen usage (p<0.05). It was observed that the fear scores of the participants who answered the surveys from their individual screens were higher than the fear scores of the participants who answered the survey by using the same screen. Only 1/8 emotional state notions' (fear) evaluation criteria differs between the participants who used different screens.

4.4. Comparison of Participants' Spatial Perception and Emotional State Evaluations According to Their Age

Comparison of spatial perception states of the participants according to their ages is shown in Table 5.

It was observed that the spatial perception parameters of Cold-Warm, Complex-Clear, Ordinary-Intriguing and Dangerous-Safe did not differ according to the participants' ages (p>0.05). However, Dark-Bright, Narrow-Wide, Confined-Spacious, Monotonous-Dynamic, Tedious-entertaining, Repulsive-Inviting, Ugly-Pleasant and general Spatial perception scores differed depending on the age of the participants.

It was observed that the scores of the participants aged 18-25, for the Dark-Bright, Confined-Spacious, Monotonous-Dynamic and general spatial perception notions are higher than the scores of the participants aged 26-35 and 36-45. In addition, it was observed that, the narrow-wide, tedious-entertaining, repulsive-inviting and ugly-pleasant perception scores of the participants aged 18-25 were higher than the scores of the participants aged 26-35.

Table 5. Comparison of Participants' Spatial Perception Evaluations According to Their Age

Spatial Perception Notions	Age	N	Mean	S.D.	F	p	Difference
Dark-Bright	18-25 (A)	57	2,75	1,34	4,861	**0,008****	**A>B,C**
	26-35 (B)	34	2,57	1,29			
	36-45 (C)	9	2,52	1,24			
Narrow-Wide	18-25 (A)	57	2,78	1,3	4,106	**0,017***	**A>B**
	26-35 (B)	34	2,59	1,23			
	36-45 (C)	9	2,65	1,23			
Confined-Spacious	18-25 (A)	57	2,58	1,29	4,191	**0,015***	**A>B,C**
	26-35 (B)	34	2,4	1,14			
	36-45 (C)	9	2,46	1,14			
Cold-Warm	18-25 (A)	57	2,56	1,28	1,839	0,159	-
	26-35 (B)	34	2,5	1,27			
	36-45 (C)	9	2,37	1,13			
Complex-Clear	18-25 (A)	57	2,76	1,32	0,505	0,603	-
	26-35 (B)	34	2,83	1,32			
	36-45 (C)	9	2,79	1,22			
Monotonous-Dynamic	18-25 (A)	57	2,76	1,19	5,82	**0,003****	**A>B,C**
	26-35 (B)	34	2,58	1,19			
	36-45 (C)	9	2,5	1,23			
Ordinary-Curious	18-25 (A)	57	2,96	1,29	2,845	0,058	-
	26-35 (B)	34	2,81	1,25			
	36-45 (C)	9	2,8	1,27			
Dangerous-Safe	18-25 (A)	57	2,76	1,26	0,657	0,518	-
	26-35 (B)	34	2,71	1,23			
	36-45 (C)	9	2,67	1,16			
Tedious-Entertaining	18-25 (A)	57	2,58	1,13	4,809	**0,008****	**A>B**
	26-35 (B)	34	2,41	1,03			
	36-45 (C)	9	2,46	1,14			
Repulsive-Inviting	18-25 (A)	57	2,66	1,22	7,572	**0,001****	**A>B**
	26-35 (B)	34	2,43	1,16			
	36-45 (C)	9	2,51	1,15			
Ugly-Pleasant	18-25 (A)	57	2,63	1,17	7,445	**0,001****	**A>B**
	26-35 (B)	34	2,4	1,11			

	Age	N	Mean	S.D.	F	p	Difference
	36-45 (C)	9	2,48	1,22			
Spatial Perception N.	18-25 (A)	57	2,71	0,82	6,44	**0,002****	**A>B,C**
	26-35 (B)	34	2,57	0,82			
	36-45 (C)	9	2,57	0,84			

*p<0,05, **p<0,01, F: One Way ANOVA Test, Difference: Post Hoc Tests

Comparison of emotional perception states of the participants according to their ages is shown in Table 6.

It was observed that the participants' Hate, Sadness, Distress, Fear and Negative Emotional state notion scores did not differ according to their age (p>0.05). However, the emotional state of Peace, Joy, Happiness, Love and Positive Emotion differed depending on the age of the participants (p<0.05). It was observed that the Peace, Joy, Happiness, Love and Positive Emotion perception scores of the participants aged 26-35 were lower than the Peace, Joy, Happiness, Love/Affection and Positive Emotion perception scores of the participants aged 18-25 and 36-45.

Table 6. Comparison of Participants' Emotional State Evaluations According to Their Age

Emotional State Notions	Age	N	Mean	S.D.	F	p	Difference
Peace	18-25 (A)	57	2,22	1,21	11,177	**0,000****	**B<A,C**
	26-35 (B)	34	1,97	1,04			
	36-45 (C)	9	2,3	1			
Joy	18-25 (A)	57	2,17	1,17	18,894	**0,000****	**B<A,C**
	26-35 (B)	34	1,84	0,96			
	36-45 (C)	9	2,17	0,98			
Happiness	18-25 (A)	57	2,19	1,19	19,503	**0,000****	**B<A,C**
	26-35 (B)	34	1,85	0,98			
	36-45 (C)	9	2,26	1,08			
Love	18-25 (A)	57	2,17	1,2	11,26	**0,000****	**B<A,C**
	26-35 (B)	34	1,93	0,98			
	36-45 (C)	9	2,28	1,01			
Hate	18-25 (A)	57	2,44	1,35	0,253	0,776	-
	26-35 (B)	34	2,39	1,19			
	36-45 (C)	9	2,42	1,09			
Sadness	18-25 (A)	57	2,53	1,34	2,924	0,054	-
	26-35 (B)	34	2,68	1,22			
	36-45 (C)	9	2,67	1,12			
Distress	18-25 (A)	57	3,01	1,36	0,316	0,729	-
	26-35 (B)	34	3,05	1,28			
	36-45 (C)	9	2,97	1,12			
Fear	18-25 (A)	57	2,79	1,45	0,117	0,889	-
	26-35 (B)	34	2,8	1,34			
	36-45 (C)	9	2,74	1,17			
Positive Emotional State N.	18-25 (A)	57	2,19	1,1	17,181	**0,000****	**B<A,C**
	26-35 (B)	34	1,9	0,93			
	36-45 (C)	9	2,25	0,95			
Negative Emotional State N.	18-25 (A)	57	2,69	1,15	0,225	0,799	-
	26-35 (B)	34	2,73	1,05			
	36-45 (C)	9	2,7	0,85			

*p<0,05, **p<0,01, F: One Way ANOVA Test, Difference: Post Hoc Tests

4.5. Evaluation of Spatial Perception and Emotional State (ESPES) Method

Depending on the first proposals and the conducted case study a method is developed to evaluate the interior perception parameters as integrated with spatial perception and emotional state and called as the "Evaluation of Spatial Perception and Emotional State Method" or as "ESPES Method" with its abbreviation.

ESPES method are basically consists of the "Determination of the Inputs", "Case Study Application", Evaluation of the Results", "Outputs" phases. Also these phases includes a number of stages as;

1. interior design variables should be determined
2. variation parameters should be specified,
3. different scenarios should be designed to represent the variations,
4. scenarios should be constructed or applied,
5. photographs of the constructed/applied scenarios should be taken,
   *(*from the same point under the same conditions except the variable)*

6. photographs should be shown to the specified participants via screen to evaluate the spatial perception and emotional state,
7. results should be evaluated to find the significant effects on spatial perception and emotional state.

These basic phases and the stages of the ESPES Method also represented in the diagram given at Figure 2. As a result, ESPES method gives outputs on “Effects of Design Variables on Spatial Perception” and “Effects of Design Variables on Emotional States” Thus, this method provides a comprehensive, integrated evaluation of the interior perception included with both physical spatial perception parameters and psychological emotional state parameters.

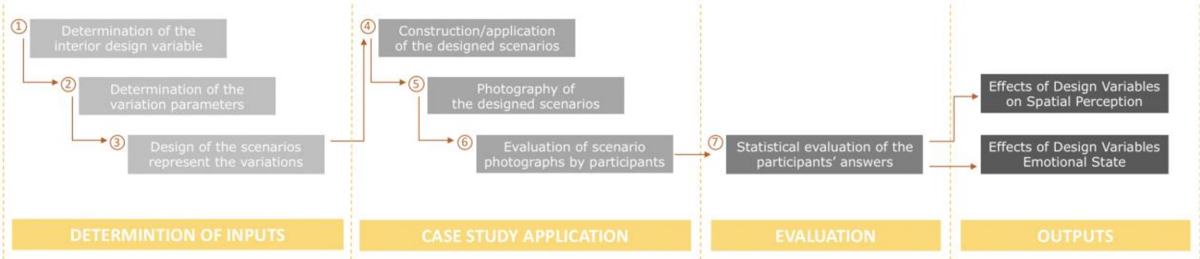

Figure 2. ESPES Method Rule Diagram

5. CONCLUSION

It can be seen that the all light variables have effect on more than half of the spatial perception notions, which means light variables affect the spatial perception notions significantly. For the emotional state notions evaluation, most of the direction variables do not have an effect on emotional state. General top, front and back directed lights generally can affect only few parameters, where the side directed light effects the half of the emotional state notions. Additionally, different light amount and light colors, affects nearly all of the emotional notions.

Also, the difference between the results of the participants’ who answer the survey by using the same screen and by their individual screens are very close to each other. Only fear evaluations changed depending on the participants’ screen usage.

Lastly age ranges of the participants also have some effect on the spatial perception and emotional state. Generally, most of the spatial perception and emotional state notions scores of the participants aged 18-25 are higher.

From this point of view, it can be stated that; “ESPES Method” can be used to reveal the effects of different interior design variables on spatial perception and emotional state to have a comprehensive and integrated evaluation of interior space perception. Thus, the potentials, perceptional and emotional effects of the flexible interiors can be examined beforehand, and this knowledge can be used to create more effective, comfortable and flexible design ideas. Even this method basically offered to design the flexible interiors easily, and the stage used as just the experiment area in this case study, the results and findings to be obtained with this method will be also useful and reliable for the stage design because the theatre and stage design also - or may be even more - deeply interested to affect the audience with emotional state and spatial perception. Consequently, ESPES Method can be used to create effective and comfortable flexible interiors and to enhance the affection of the audience in theatre.

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