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Emotion and interior space design: an ergonomic perspective[1]

Swathi Matta Reddy*, Debkumar Chakrabarti and Sougata Karmakar
Department of Design, Indian Institute of Technology Guwahati, Guwahati-781039, Assam, India

Abstract. Interaction between the users and their environment is spontaneous and unavoidable. This interaction can be positive or negative. A good interior space is about considering all the physical, environmental and cognitive elements and harmonizing them to make it a space that feels right, functionally and emotionally. The important element that has to be considered the most in an interior space is the "user". Balancing all these elements is a challenging job and results in a perfect interior space design. This paper intends to bring to light the necessity of designing an optimum interior space, which is a balance of the user's choice and the mandatory standards that ought to be followed for user safety and convenience. There has to be an intervening domain of ergonomics which will guide to bring out a balance between the personal choice of the user and the usual standards followed. It should also provide a step-by-step information, guidance and direction to act to the specifications and standards systematically to adapt an integrated approach of handling all the elements holistically which will indeed result in a good interior space.

Keywords: interior space, ergonomics, environmental factors, design, psychology

[1] Corresponding author E-mail: swathimr127@gmail.com,

1. Introduction

Cognitive neuro-science is drawing the attention of researchers all over the world; context specific psychological emotions evoked by physical and environmental attributes of personal interior space is a highly interesting research topic today in global scenario. The user's interaction with the immediate environment is instinctive. An interior space constitutes of many elements comprising varieties of physical factors, space and human being. Few of these elements are attributes of physical entities (color, texture, form, empty spaces etc.) and the other being environmental factors (light, sound, temperature, humidity etc.). Balancing these elements is a challenging job and this result in a perfect interior space design. Harmonizing the elements in an interior space is of utmost importance [19]. An interior space that makes the user feel disjointed, off-balanced or inconvenient to use is a resultant of handling each of these elements individually. Culture is also an important guiding factor in interior space design as people's psychology is influenced by culture. Physical environment affects people and their culture and vice-versa. People, cultures and physical environment, cannot be understood in separation but all three should be considered in unity [1]. Therefore, culture, people and their physical environment has a strong embedded connection. Different cultures see their physical environment in very different ways. For example, in Oglala Sioux Indian's conception, the world is circular and they design their homes and communities accordingly. But ancient Chinese societies conception was the rectangular quality of the world and they designed their communities accordingly [1].

Man being the prime component for an interior space design, emotion plays a significant role of determinant in any sort of design. This emotion can be defined as complex psycho physiological experience of an individual's state of mind which can affect positively or negatively [38, 17]. A well-designed space evolves from emotion and such a space should embrace and engender the emotional support which the user aspires. The present paper deals with the importance of all individual factors in an optimum interior space which satisfies user's emotional need along with the standards and norms. National and international standards relevant to ergonomics of space design and behavioral psychology indicate the link between the emotional needs, comfort and user safety [48, 39]. This provides an understanding of the relation or the association between the human and the built environment. Recognition of the individual as well as group emotional choice regarding the space and its utility brings it utmost completeness. In contrary, if the choice is completely given to the users, it may lead to confliction and compromise with the technical aspects of the interior space. Different aspects in integrating all the elements of an interior space are being explored in this article. In this article focus has been made on putting forth the need of an intervening domain of ergonomics which will guide to bring out a balance between the personal choice of the user and the usual standards followed.

2. Physical entities in an interior space

2.1. Color

An interior is a three-dimensional space that completely encloses in color. Therefore, interior color is experienced quite differently from any other color use. In interior design, color has the most powerful, affective and the most mysterious influence [12]. In the viewpoint of a psychologist, "Seldom, surely, is the psychological part of an appearance in nature as great as it is in the case of color. No one can encounter it and stay neutral. We are immediately, instinctively, and emotionally moved. We have sympathy or antipathy, pleasure or disapproval within us as soon as we perceive color" [6]. These experiences of color have their roots in conscious, subconscious, and unconscious processes of human behavior. The human reaction toward any color, or a color combination, or an environment is initially a psychological one but later it is physiological as well [32]. Numerous studies concerning the effect of color on mood have established certain general principles regarding the mood creation of a wide range of colors [29, 23]. The reactions to colors are dependent upon cultural associations, trends, age and the individual preferences

[2]. Colors have specific symbolic meanings in different cultures [15]. In the ancient Indian treatise on the performing arts called 'Natyashastra', there exists 'Navarasa' which portrays nine moods of the people and each mood is given a particular color [18]. According to astrology and Hindu system of design based on four directions called 'Vastu Shastra', every direction is assigned a color and each color having its own implications [49].

It is principally accepted that good taste alone is not an adequate basis for making interior color choices, especially for buildings which entail complex functions and a diversity of people. There are few important factors influencing the choice of color while creating an interior space depending on the usage of a particular room or an enclosure. A judgment in choosing a scheme dominated by warm, cool or neutral tones could be influenced by several factors such as climate, orientation, activity, and the preference of the user [40]. An interior surface color is a dynamic energy and it does not sit idly by. Same color has different responses depending on its location (top, sides, and bottom). For example, the color red for ceiling results in a feeling of intrusion, disturbance and heaviness, while used on walls feels that it is aggressive and advancing, and the same red on floors can make us feel conscious and alert [31]. Warm colors are preferred in residential interiors that have association with comfort and homelike ambience [40]. Color can be used to increase and decrease the legibility of an interior, it is a prime instrument for creating illusions, and it influences the visual weight, size and distance of objects and surfaces. Therefore color should be chosen carefully keeping its characteristics and effect in mind. Miller (1997) stated that color in an interior space acts as light, perception, energy, communication and magic [36]. Many interrelated elements including space, form, structure, light, texture, and color are manipulated and applied in interior design or architecture [42]. Though all of us belong to the same universe and carry over the same inherent order of things in our lives, we have different choices of color. All of us have a personal color palette and not all of us need the same dosages of color. If color is used entirely on one's random choice for decoration, a feeling of visual imbalance can occur. The "Color Experience Pyramid" suggests the six basic levels of how color is experienced or how to be conscious of color [32]. While creating a good interior space, these personal color palettes should not interfere with the universal system of color [33]. People may feel physical discomfort from the dissonance of color, and at other times they may also feel emotionally upset. Therefore, careful planning of color is essential.

2.2. Texture

Texture brings the sense of life in a room and it is an element that you see and touch. One common use of texture is to add interest to a space which has boring, monochrome colors. The texture of an element describes the very materials that it is made from and it is the stuff that is touched, felt or handled. The specific choice of materials imparts character upon the living space and builds a direct relationship between the people who occupy the space and the building itself [9]. Even if the quality of coarse rough concrete finish is different from the polished marble and studded rubber or fun fur, they can viably be placed in an identical position [10]. Thoughtful and creative use of texture can add a whole new dimension to a room. Rooms filled with texture provide an experience which could be boldly stimulating or quietly relaxing depending on the choice of texture. Plenty of varieties of texture like velvet, suede, perspex, steel and stone can be combined, juxtaposed, or used individually to produce a stunning effect [24]. It is important to balance texture with color to provide a harmonious environment. While using texture, it is also essential to be aware of absorption/reflection of light altering the quality of color. For example, smooth textured surfaces reflect light and rough surfaces absorb light. Excess light can flatten the out texture and cast a shadow, and thus there is loss of surface definition. So, planning the amount of light with respect to the textures in an interior is required. There is an unavoidable reciprocal relationship of texture with the other elements and balancing them is indispensible.

Size, scale and proportion should be taken into consideration with pattern and also, texture has a major relation with weight and it is one of the basic principles of using texture. Rough, coarse textures tend to make an object feel heavier, while smoother textures will make it feel lighter. A polished white marble floor will feel lighter than hardwood paneling, even though the marble is in actuality much heavier [3]. Therefore, the texture of a particular interior cannot be applied

randomly but has to be chosen depending on the utility of the room and also concerning the user's choice. Texture not only provides deign strength when necessary, but also signals personality.

2.3. Forms and empty spaces

Creating visual harmony through balancing space and material forms is essential in an interior space. The shape and structure of the solid objects can well-define form in an interior space. Form can achieve certain effects of stability, weight and so on. For example, a large sofa or a piano usually gives a feeling of stability. Sometimes, the same form can appear heavier or lighter depending on the color and texture of the object. Similarly, a space is also influenced by colors. For example, dark colors make an interior space look smaller.

An object or a series of objects can provide focus to a space, facilitates or encourages movement; it could supply rhythm or balance and can promote direction, both visual and physical. It could be the scale of an object, a piece of art or furniture [9]. Contemplating scale, proportion, and breathing space between furnishing and architecture is essential. Lynch (2005) stated that it is better to keep it minimal in smaller spaces, with each piece in the interior complimenting the rest of the furnishing and architecture. It means that the level of elaboration or ornamentation depends on the size of the room [30]. Heavily stuffed rooms might not be a good interior space. "It's not about buying furniture and filling space. It's creating space" *said Suzie Frankfurt, Interior designer* [30]. There exists a balancing formula between the space and forms with the architects which suits best for different environments.

3. Environmental factors in an interior space

3.1. Lighting

A proper lighting enables us to perform tasks easily, making us feel safer, more comfortable, and allows to enjoy a living space at its full potential [45]. Every room has its own specific and unique lighting needs. The insufficient or inappropriate light exposure can disrupt standard human rhythms which may result in adverse consequences for performance, safety, and health [7]. Every room has its own range of minimum and maximum illumination levels which depend on the purpose and utility of an interior space. All national and international set of recommendations for lighting contains such illuminance recommendations [26]. Patterns of luminance contrast evoke positive emotions in the same way as background music [16]. The history of illuminance recommendations shows considerable variation, in different countries and at different times [37]. The recommendations of illuminance value for generic types of activities in interiors are readily obtained [16]. The major concern in lighting of the interiors has primarily been to allow visual comfort suited for its usage and however, light has other implications of health and well-being which merit consideration in the lighting, and use of day lighting, within building [51]. Light reveals the space and defines the form in an interior space [9]. Color and lighting can have an impact on peoples' perceptions and responses to the environment [8]. There are colored lights and are used in different environments depending on the occasion. This reveals that light has its correlation with other elements in an interior space. There are various light sources and natural daylight is most essential one. Solar radiation, daylight, has profound influence on physiological systems of human being. Apart from vision it also controls the circadian rhythm of hormone secretions and body temperature with implications for sleep/wake states, alertness, mood, behavior and so on. Symptoms of the disruption of these cycles through changes of the natural light/dark cycle can range from temporary jet lag to severe depression [11, 51]. This suggests that the building plan should have a proper plan for openings (like window/doors) for the daylight to enter in. There are fixed rules for it while building the house but might interrupt the liking of the user. Again, the question of balance comes in as to how to satisfy the user as well as the technical aspects of lighting in an interior space.

3.2. Sound

Acoustical consideration is one of the important factors that ought to be considered while designing an interior space. Sound is a spatial element which is

never absent. John Cage said that there is no such thing called an empty space or an empty time but there is always something to see and something to hear, even if we try to make a silence we cannot [20]. Health, safety, productivity, comfort, human factors and functionality are affected by noise. Music can evoke emotions at an individual level as well as interpersonal and intergroup level [27]. Musical sound with harmony can result in positive emotions and peace while interrupted noises can have adverse influence in a dwelling space. Interior spaces with bad acoustics can lead to excessive noise. This can cause anxiety, headaches, digestive issues, stress, high blood pressure, heart problems and other physical ailments for the people living in. Although the human response to sound depends on age, physical conditions of the ear, the background and other factors, there are few guidelines to follow [5]. The acoustical usability of the space is determined by the functionality of the space. Sound absorption and reflective materials are chosen to effectuate the required acoustics in a living space. Hard materials bounce the sound around a space while soft materials absorb sound providing a calm environment [34]. Noise can be controlled by thoughtful specifications of flooring, wall treatments and ceiling materials [41]. Absorption materials are usually added or removed from a space to achieve the amount of sound required in a given living space. Such materials include carpets, rugs, furniture, large pillows, heavy draperies and so on. There are specifications regarding the composition for building walls depending on the kind of building or room [22].

3.3. Temperature and humidity

Maintenance of a comfortable indoor climate with appropriate temperature and humidity is essential for well-being and performance at maximal efficiency. In an interior environment of a building, rate of air-flow, temperatures and concentrations of pollutants requires to be checked to ensure comfort conditions and indoor air quality [47]. Numerous studies have proven that indoor climate impacts both health and performance, which in turn affects productivity. Technology has been developed to improve indoor climate such as controlling indoor temperatures [21, 43, 46, 44] and increasing ventilation [13, 50, 14] which are undoubtedly advantageous when refurbishment costs, operation and maintenance costs, and the financial effects on both health and productivity are taken into account. Overheating causes weariness and sleepiness, reduced physical performance and increased liability to errors. Similarly, over-cooling results in restlessness, which in turn reduces alertness and concentration, especially on mental tasks. The air temperature in winter should be between 20° and 21°C and in summer between 20° and 24°C for comfortable indoors. And the relative humidity in heated rooms should be 40-50 per cent for comfort and below 30 per cent becomes unhygienic because they adversely affect the mucous membranes of nose and throat [28].

4. Discussion and Conclusion

In the previous sections, discussions have been made regarding influence of culture with individual physical entities of interior space (like color, texture, form, empty spaces, etc.) and also for various environmental factors (temperature, sound, humidity, air flow, illumination level etc). Individual effect of these various factors on human emotions should also been taken into account. Study of the individual factors cannot clearly indicate their collective effect on user's emotion because all these factors influence human emotion in a completely different fashion when they are alone. Resulting emotion is actually the integrative effect of all the physical, physiological, environmental and cognitive/psychological factors.

Each element plays its role vitally and influences each other to an extreme extent. Color has the potential to communicate instantly regarding the atmosphere and style; it creates an illusion of space visually. Some color theorists suggested that emotional responses to color and form are related in a predictable way. Texture and the nature of surfaces can influence human emotion [40]. Lighting plays a critical role in form perception [35]. Curved shapes in an interior can look more welcoming than the straight and upright ones. Fabric (color and texture) will also need to suit the shape and style of a piece and the actual positioning of it in the space. One of the common practices of controlling noise within a space is adding absorptive materials [5]. Therefore, texture of a living space has an influence on the sound. If positioning of a lamp in a room is the idea, consideration needs to be given not only to the lamp but to all the specifications including the type,

size, color and wattage of the bulbs; the size, shape, material, and color of the lampshade; the color of the lamp lining; and the color of the flex [19]. There is a large inter relevance of different elements acting on each other. Therefore, harmonizing all the elements is essential and needs careful consideration.

A user is bound to embrace the value of using an interior space and the effort is to make it pleasurable to live in. Elements of an interior design include the functionality of the space, as well as the intention or mood of the room. Based on the available scientific literatures and national/ international standards, an interior space can be designed as optimal/ perfect but it cannot be assured that these specifications of the interior space would satisfy emotional need of the user as it is solely guided by individual preferences. To what extent can we compromise on scientific data in order to satisfy the user? This is a question which is yet to be answered.

Present article establishes a firm evidence of the inter relevance of all the elements of an interior space and sights the need to balance the personal choice (emotional need) of the user and the usual standards followed (for safety and comfort). It also shows that there is a requirement for a realm of science which is inter-disciplinary like ergonomics that deals with understanding of interactions among humans and other elements of a system and applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance [25]. It takes into consideration the human physiology, psychology, and the cognitive abilities. Therefore a need for development of an intervening domain of ergonomics which will facilitate by providing step-by-step information, guidance and direction to act to the specifications and standards systematically to adapt an integrated approach of handling all the elements holistically and to bring out a balance between the personal choice of the user and the usual standards followed which will indeed result in a good interior space.

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