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# A Study on the Effect of Colours in Architecture Towards Healthcare Users

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Colour is an essential architectural component in the built environment and human behaviour; it is widely used to enhance the aesthetic value of architecture and design. Furthermore, utilising the correct colour selection can speed up the healthcare process by reducing healing time, increasing recovery rate and providing mental and physical comfort for patience. The research used a 2-phases questionnaire to identify affective factors in a healthcare facility's exterior or interior area and get users' affective responses and judgments based on changes in colour hue. The assessment consists of nine colour palettes of a certain area for participants to stimulate sensation and designed a Likert scale to assess the affective impression from the nine colour palettes rendered image. The overall result showed that Light Blue is still the most preferred colour in healthcare projects due to its positive effect on visual comfort, serenity and a sense of healing. The findings could have practical implications for future architects and construction designers, allowing them better to understand the value of healing properties in architecture. Meanwhile, by emphasising the element of colour, the study could serve as a design blueprint for the healthcare project.

**Keywords**: Healthcare Project, Architectural Component, Healing Architecture, Chromatic Characterisation, Psychological Factors

## 1. INTRODUCTION

Colour is one of the essential components in our world, whether natural or built environments. Many studies have proven the factor that triggers human emotions toward architecture and design (Ulrich et al., 2008 & Joseph & Hamilton, 2008), particularly colour (Gray et al., 2012), which is a variable factor.

According to Tofle et al. (2004), colours that affect a particular emotion or influence human behaviour are not scientifically proven. However, some studies have written that a correlation between colour and mood existed but cannot be proven to have a solid relationship or variable factor between colours and emotion. For example, some designers conclude that a white painted wall shows serenity and cleanliness, but others might disagree, saying white walls are clinical and eerie.

In 1912, a European architectural space was built for medical purposes with different specific colours. They are using different colours for hospitals in series for treating patients with nervous disorders, which has gained recognition and significance in the medical field (Farrer-Brown, 1959). Ever since, architects and designers have been integrating colours and specifying each colour used for hospital spaces and rooms to bring advantages to patients' outcomes (O'Connor, 2011).

Colour study is categorised in mental and psychological science because it is primarily used in the sensation of a subject (Faber Birren, 1973). As in the architectural component, colour is an aesthetic function that affects perceptions of

overall design (Moughtin et al., 1995). Colour in interior spaces affects resident satisfaction and psychological and social functioning. The architect must choose colours based on the sensory responses people are likely to have in that environment and then select colours that will have the best effect. Consider a prison with bright, stimulating, aggressive reds and oranges or a hospital wing with the same flashy, clashing colours used for rest and recovery.

Interior designers who use paints, fabrics, and furniture to create a mood aren't the only ones who use colour design. For example, there is a wall with vibrant colours and different materials that pop on various surfaces, such as cushioned padding for safety precautions; it creates an atmosphere of fun and enjoyment that stands out from other grey and pastel-coloured hospitals room. The difference in atmosphere and feel between the two designs is palpable, with the second design having a much better chance of recovery. The colours are the only thing that has changed.

The needs of patients and staff determine the success of a project in healthcare. To reduce the patient's recovery time and relieve their stress and pain, some specific values need to be noted to provide them with a sense of comfort. The healing properties of architecture have been widely promoted worldwide in the last decade, but the concept of "healing architecture" is far from new (Simonsen et al., 2022). Paimio Sanitorium in Finland, designed by architect and designer Alvar Aalto in 1930, is still a model for how hospital buildings can meet patients' physical and mental needs.

Most worldwide architects are beginning to tackle the health crisis with an inclusive design approach targeted at improving patients' health through architectural components, particularly colour, especially during the pandemic. However, even though the colour is a universal property of all architectural surfaces, there is still not much evidence and proof in past research where architectural components rely on colour chromatic preferences where colour also affects psychologically in healthcare projects (Costa M,2018).

## 2. LITERATURE

### 2.1. Role of Colour in Architecture

According Colour research in various scientific traditions begins with fundamental questions and employs different methods and concepts. It is challenging to communicate and evaluate the results in a broader context. We start by discussing the need for colour knowledge among architects and then move on to studies between colour appearance and colour emotion that links with architecture and design.

Understanding the perception of colour better would benefit architects while designing a project. Architects always work in three-dimensional and complicated situations (Anter et al., 2010). For example, it could be building exterior or interior and coexists with other components such as natural environment, artificial artefacts, etc.

According to Anter (2010), there are fundamental colour errors in architectural design. An individual needs to understand better the relationship between chromatic colourisation profile selected colour in a spatial situation, psychological colours, and fixed colour on the material of surface that provides comforts and soothing environment. It is essential to understand colours and their effect on the external and internal environment before it is built into shape or repainted in refurbishment and prescribing the type of materials and paints that will achieve the desired outcome.

### 2.2. Advantages of Colours Towards Human

Lights produces colour in a form of energy, it affects the function of our body, minds and emotion. Although the eye is the organ of sight, studies on psychosomatics, psychology disciplines, colour and architectural psychology have shown that the brain perceives the image. Millions of nerve endings in the eye's retina observe and transmit the image to the related part of the brain, resulting in image perception. Through advance technological studies, it is proven that colours affect brainwaves, nervous system, and hormonal activity by stimulating different emotions. In other words, colour affects us both physiologically and psychologically (Bellizzi et. al, 1992).

The thinking of brain and action relayed are linked. A person emotion such as happy, angry, sad and anxious is caused by stimulation of brain. The central nervous system is the brain's main control centre. According to research, each stimulus received by nerve cells affects the brain stem before spreading throughout the nervous system. Throughout the day, humans are exposed to various stimuli, including sight. These stimuli can be few or numerous.

## 2.3. Role of Colour in Healthcare Environments

Although few empirical studies exist, O'Connor (2009) suggested that colour has a therapeutic impact. Edelstein et al. (2008) evaluated citations from the biomedical literature, although there was a lack of reliable evidence on the effect of applied colour on health. It is known that the impact of colours projected on health is supported by many researchers through circadian rhythms. Still, there is a lack of constant and consistent data regarding health is affected by colours.

According to Tofle et al. (2004), the popular press oversimplified psychological responses to colour, and direct application to architecture and interior design of healthcare facilities appears "nonspecific and oddly inconclusive". Therefore, it is recommended to formulate a universal guideline for using specific colours in healthcare settings and facilities as there is no solid scientific proof to integrate significate colours in hospitals.

Schuschke and Christiansen (1994) concluded their study of 68 patients. For example, they discovered heterogeneity in patients' preferences for sickbay colour in clinics and found no supporting proof for colour preferences. However, the results from 68 patients preferred light colour schemes for all architect and interior components, for example, floor, wall, ceiling, furniture, etc.

### 2.3.1. Colour Research's Current State

Many colour guidelines for healthcare settings have been proposed, but they are only hypotheses that specific colours may be linked to the well-being of those who use those spaces. Tofle et al. (2004) conducted a comprehensive analysis and review of colour guidelines. They found that findings showed significant inconsistencies among policies and literature on colour.

In addition, Edelstein and colleagues conducted a thorough review of peer-reviewed literature on the effects of light and colour on emotion, function, behaviour and health (Edelstein, 2006; Edelstein, 2008; Edelstein et al., 2008). They discovered the most consistency in colour research that concentrated on colour contrast and brightness, which aligns with what they've learned from clinical research and visual science. These relevant studies are intended to control sensations, such as a sensation of spaciousness. These studies concluded insufficient evidence directly linking specific colours to specific behavioural or health outcomes.

### 2.3.2. Colour Impact In Healthcare Environment

| Author | Date | Title | Result |
|---|---|---|---|
| Goldstein, L. H., & Oakley, D. A. | 1986 | Colour versus orientation discrimination in severely brain-damaged and normal adults | Colour can assist a patient or an individual with spatial disorientation & wayfinding. |
| Stone, N. J., & English, A. J. | 1998 | Task type, posters, and workspace colour on mood, satisfaction, and performance | It affirms that warm colours are stimulating and cold colours are relaxing and reduce stress. |
| Hager W. | 2001 | Colour and Room | The ability of office workers to focus was impacted by colour, and office |

| | | | |
|---|---|---|---|
| | | | workers' focus levels were lower in grey-coloured spaces. |
| Meerwein et al. | 2007 | Colour-communication in architectural space | A well-planned interior's colour has been known to be a de-stressor in space because colour stimulus and stress are closely related. |
| Dalke et al. | 2008 | Colour and lighting in hospital design | The environment's visual components can enhance a patient's well-being, satisfaction and emotions. |
| Ulrich et al. | 2008 | A review of the research literature on evidence-based healthcare design. | Hospitals are more healing for patients and better places for employees to work when the physical environment is well-designed. |

Table 1: Significant Research Studies and Result.

### 2.4. Colour and Human Perception in Architecture

Colour is one aspect of design that significantly impacts how space affects its users. Colour is one of the ambient environmental variables that has been shown to influence mental activity in studies. Red, for example, causes motor excitation and thus affects motor activity, making it unsuitable for use in spaces intended for focused cognitive tasks (Nakshian 1964).

Colour emotion studies are essential for understanding the selection of colours to achieve emotional results in a design that links colours with human emotions, attitudes and judgments. Therefore, rendering colour is critical in creating a feeling in a room or building in architecture. Many resources and topics have been looked into for correlations between colour preferences and basic human feelings and emotions such as happiness, fear, and anger as a whole direction. (Hårleman 2004; Oberascher, L. & Gallmetzer, M. 2003)

#### 2.4.1. Colour Preferences of Children

In healthcare architecture, a few studies looked into children's colour preferences (ages 7-11). Park (2009) has used five hues (Munsell colour system) to investigate colour preferences among children, including healthy children, paediatric inpatients, and paediatric outpatients. Except for the five hues (yellow, red, green, purple and blue), white was also included due to its commonness in the healthcare architecture.

The test result proves the hypothesis is faulty, where patients with health issues and healthy children have different colour preferences, respectively. Three groups of children have statistically significant similar colour preferences. By analysing the colour preference of children, white is the less-favourite, and the second-less preferred colour is yellow. The author concludes that many variables such as light, brightness, saturation, emotion, and cultural factors need to be controlled so that the colour study can succeed in healthcare architecture.

In an acute-care hospital in the United Kingdom, Coad (2008) undertook a two-phased participatory research study (interview & questionnaire). In the interview session, children who were or have been inpatient are requested to choose their preferred colour from a 100 colours thematic design chart. Thematic findings developed a questionnaire tool for Phase 2 to emerge a series of photos of the hospital and seek children's views about the colour preference in each hospital area and space.

The overall results are matched to Boylan (2004) and Redshaw & Smithell (2000), who concluded that children preferred the mid-colour range. The mid-blue-green colour won the most favourite colour of 100 colours. Children's colour preferences are expected to lead to a brighter colour range. However, opposite to the hypothesis, the chosen colours were paler to mid-colour (Coad et al., 2008).

#### 2.4.2. Colour Preferences of Teenage

To better understand teenagers' colour preferences regarding hospital physical design, Blumberg & Devlin (2006) proposed a questionnaire based on demographic and an observation comparison task and distributed the

questionnaire to 100 students aged 12-14 years old that had been hospitalized for more than a day.

The result is still based on personal preferences and imagined circumstances from a big portion of the respondent. Predictions of behaviour may be inaccurate unless an individual has been hospitalized. (Blumberg & Devlin, 2006)

### 2.4.3. Colour Preference of Aging

In addition to the influence of visual disorders and dysfunctions, the effect of ageing on colour preference should be taken concern, especially in a healthcare environment. A human optic visible changes thru ageing and yellowing, where the perception of colour and counter react towards darkness and glare if the domain is perceived.

A study applying a colour naming test with participants of 80-year-old fellows discovered that preference order remained stable and relatively consistent with previous studies (Wijk et al., 1999). Therefore, Mather (1971) used four colour cards to determine geriatric patients' colour preferences. The four colour cards use yellow, blue, green, and red. The clinical research showed "blue preference" results consistent with the other studies.

However, a recent study (Dittmar, 2001) states significant differences in colour preferences among the elder. Blue picks are less likely preferable as we age and tend to prefer red or green. Therefore, this research proves that the changes in colour preference thru ageing oppose the trend reported in earlier studies.

## 2.5. Colour Selection and its Effect in Psychiatric Hospital

Colour changes in a psychiatric hospital corridor can provide a sense of nature and thus reduce the "institutional" feeling of the space (Edgerton et al.). Chi-square analysis was used to compare the perceptions of patients and staff on the corridor before the changes made through design and after.

The floor, ceiling, and walls were painted in natural colours, primarily blues and greens. The transparent glass was replaced with opaque glass to block unattractive views while allowing light to pass through, and two paintings were added before "institutional-style" panels were removed from the walls. Researchers used behaviour mapping to see if the public in the hallway or corridor was engaging in positive social interaction, such as getting coffee and talking with others or in negative social interaction, such as staring into space, smoking or talking to oneself.

The number of patients using the corridor was unaffected by the design and colour changes, but they increased their verbal communication behaviour. Although the difference was not statistically significant, it increased the positivity in the patient's attitude and behaviour. According to the researchers, patients prefer the hallway or corridor to be quieter, cleaner, and more likely to make them feel comfortable and pleasant. Further, the health workers prefer redesigning the corridor and hallway to be less saturated and more ventilated than the previous design.

### 2.5.1. Colours affected by Cultural Background

Because certain colours have specific restrictions in some countries or regions which may invoke one another, colours may affect people with diverse cultural backgrounds differently. For example, white means purity and cleanliness in the United States, whereas China claims it as the mourning of the deaths. The study debates the extent to which culture influences human responses to colour. Many colour-emotion relationships are "culture-independent," despite the widespread belief that culture significantly impacts human responses to colour.

The scale between warm and cool, weak and strong, dynamic and passive, was used by Gao and Xin (2006) to record 70 respondents' emotional cast towards 218 different colours. Natural causation may affect the cross-culture consistency between emotion and perception of colours, which will not be influenced by culture and personal experience. This is just a sampling of what's available, but many cultures still affect the perception of humans towards colours. Throughout the years, there have been preferred and prohibited colours to use and avoid in various cultural backgrounds, although all of it is not scientifically proven to be correct.

## 3. METHODS AND MATERIAL

### 3.1. Methods

The methodology development centred on two proposed objectives: identifying affective factors in a healthcare facility's exterior or interior area and getting users' affective responses and judgments based on changes in colour hue. A series of questionnaires were developed to elicit replies from users. It was separated into several sections of the question. First of all, it gathers individual general information on age, gender, and other relevant backgrounds. Therefore, the survey consists of two-phase on the proposed objective.

#### 3.1.1. Phase 1: Identify Affective Factors on Exterior or Interior Area

This phase aims to identify the affective factors characterising a healthcare facility's exterior or specific interior. The main objective in this phase is to stimulate sensations and achieve sufficient variability. The assessment will be a set of renders of 1 exterior view or five interior specific areas of healthcare architecture, present in nine different colour palettes and visualised—the space designed with a set of elements that match the areas.

#### 3.1.2. Phase 2: Analysis of the Influence of Changes in Colour Hue

The primary goal of this stage is to determine how the variable colour influences users' emotive responses and overall appraisal of a given environment. A questionnaire will be designed using a Likert-type scale to assess the stimuli provided during visualisation. The questionnaire included a series of affective impressions or representative characteristics from the users' subjective choices received in Phase 1 and an open question about the reason for choosing the colour in Phase 1.

### 3.2. Materials

Osmann (2002) highlighted the importance and benefits of using a virtual reality system in a research experiment. The three-dimensional model of the room was created by using SketchUp software. Colours, materials, and lighting will apply using the Autodesk 3ds Max and Chaos Corona, a photorealistic rendering engine. Rectangular images in nine different colours from one of the three points of view. It contains a standard design of healthcare facility Exterior Design, Waiting Lobby, Hallway and Corridor, Nurse Station, Consultation Room and Patient 2-Bedded Ward.

#### 3.2.1. Exterior of Hospital Design


Figure 1. Nine types of colour variation on hospital exterior design.

#### 3.2.2. Waiting Lobby


Figure 2. Nine types of colour variation on hospital waiting lobby.

### 3.2.3. Hallway and Corridor

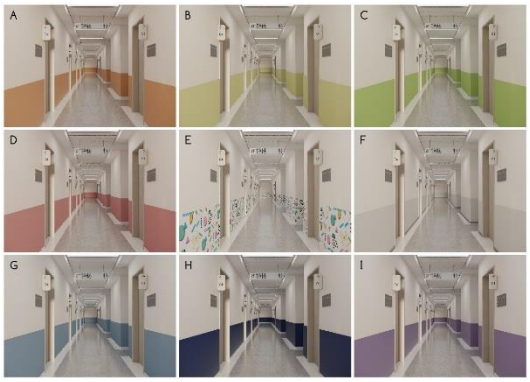

Figure 3. Nine types of colour variation on hospital hallway and corridor.

### 3.2.4. Nurse Station

Figure 4. Nine types of colour variation on hospital nurse station.

### 3.2.5. Doctor Consultation Room

Figure 5. Nine types of colour variation on hospital doctor consultation room.

### 3.2.6. Patient 2-Bedded Ward

Figure 6. Nine types of colour variation on hospital 2-bedded ward

## 4. RESULTS & DISCUSSION

### 4.1. Results

#### 4.1.1. Demographic

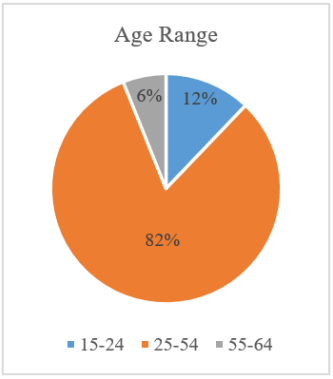


Figure 7. Age Group.

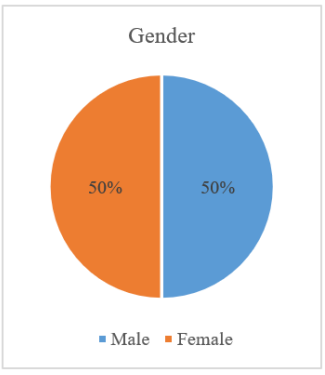


Figure 8. Gender.

There is in a total of 66 participants took part in the questionnaire. According to Malaysia's age structure, the participant is divided into three categories of age ranges. As shown in Figure 7, 81% out of 100% of the participants are 25-54

years old, which is 54 people; therefore, 4 out of 66 participants are 55-64 years old while the rest is 15-24 years old. Figure 8 shows that the participant gender is balanced for both.

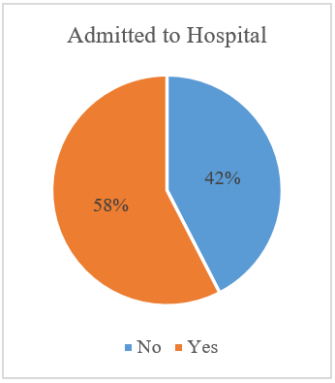


Figure 9. Ever admitted to hospital.

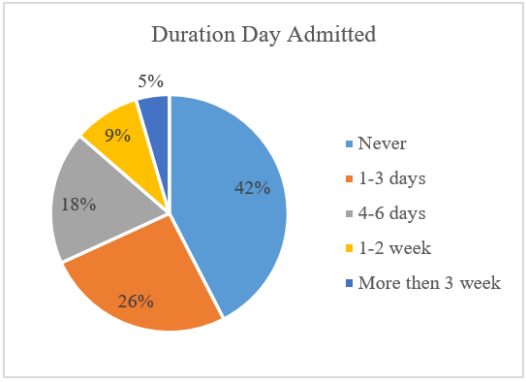


Figure 10. Duration day admitted to hospital.

In the first part of the questionnaire (general information), we also consider whether participants were ever admitted to the hospital. Figure 9 shows that 58% out of 100%, which is 38 participants, have been admitted to the hospital, and most stay there for 1-3 days (Figure 10). There are a few main reasons they are admitted to hospitals, such as complex or minor surgeries, serious illness, traumatic injuries, childbirth and other.

### 4.1.2. Colour Preference Data

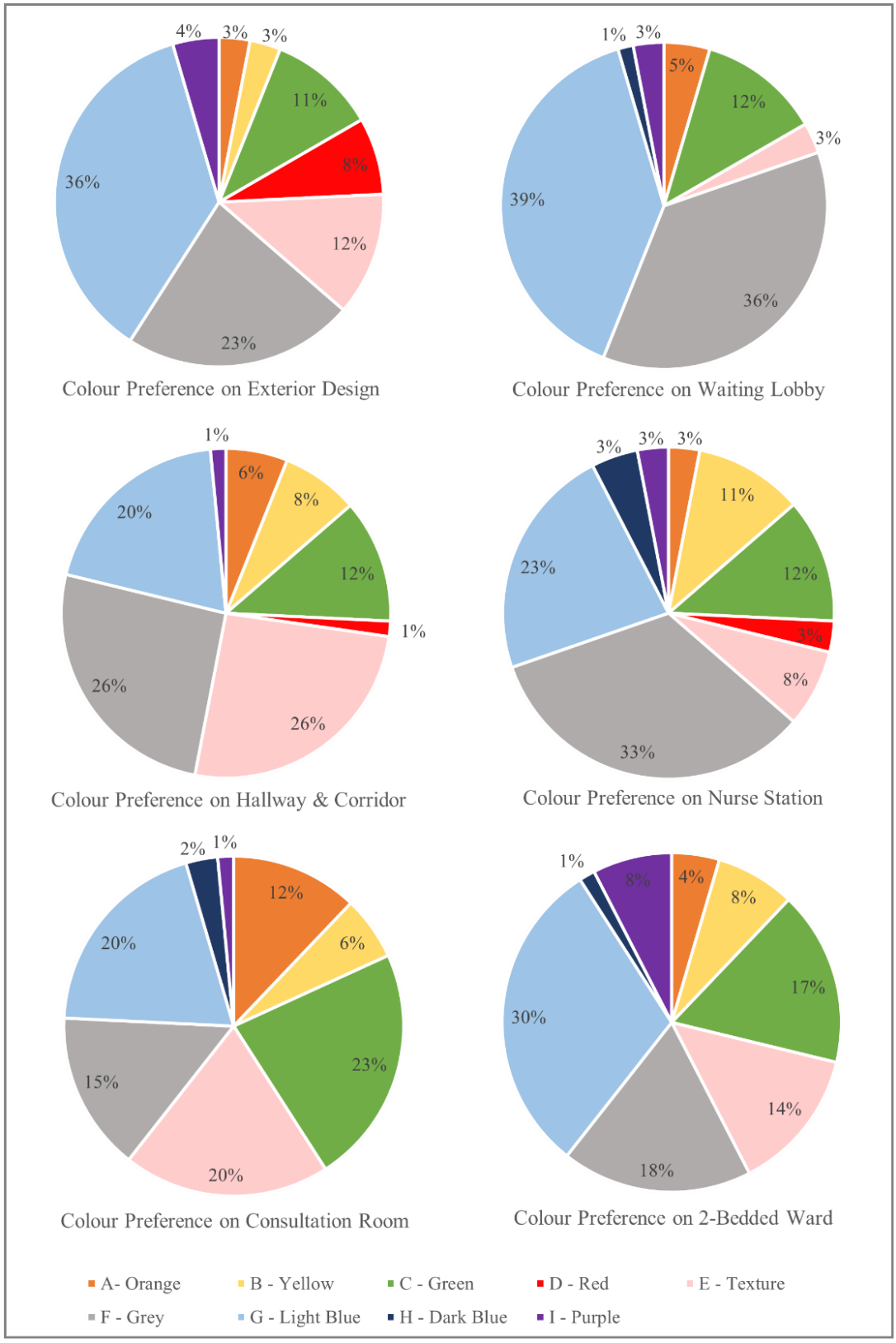


Figure 11: Colour Preference on Each Type of Render.

## 4.2. Discussion

According to the result obtained through interviewing and responses from the questionnaire from various local citizens, below are the discussion based on their choices and opinion on how colour affects the mood of patience and staff productivity based on different categories.

### 4.2.1. Exterior of Hospital Design

According to the result obtained in Figure 11, the majority would prefer utilizing Light Blue (36%) for the exterior outlook. The Light Blue outlook of the exterior differs from the rest as it will look more comfortable to enter and creates a relaxing element. From the response, Light Blue stands out from the rest because of a few of its criteria, such as it is known for a pleasant, comfortable, peaceful, and reliable and most answered it as a sense of healing. Grey is also considered by the majority (23%) because it is most commonly used in Hospital outlook, causing a mainstream and common preference among users.

Some respondents also chose Green, Red and Texture as the preferred colour for exterior design, which is 11%, 8% and 12%, respectively. They explained that hospitals or healthcare facilities have consistently been recognized and categorized as 'bad' places or stressful venues. Therefore, designing these facilities in more fun and playful colour can create a more welcoming and fun environment for the patients and surroundings. In addition, the minority would go for pop colours such as Yellow (3%), Orange (3%) and Purple (4%).

### 4.2.2. Waiting Lobby

Based on the result obtained in Figure 11, similar to the exterior outlook preferences, most responses would go for a Light Blue (39%) on an accent wall in the Waiting Lobby of the Hospital. A colour with a nearer score than Light Blue is Grey (36%), under the cool tone variant in the colour wheel. The third most preferred colour is Green colour, which is 12%. The least is Dark Blue with 1%. Meanwhile, the minority chose Purple (3%), Texture (3%) and Orange (5%). In this session, there is no one vote for Yellow and Red.

From the responses, it can be concluded that in a Waiting Lobby of a hospital or healthcare project, respondents believe the colour that can provide a welcoming, serenity, and sense of calm can improve the occupant's emotions and comfortable in psychological fact. It had been a norm, and a sudden change of colour will affect people's mindsets, especially the elderly. Therefore, the presence of healing and calmness is undeniably attached to the colours Light Blue and Grey.

### 4.2.3. Hallway and Corridor

The result gathered using the questionnaires shows that the number of votes for corridor preferences is equal in both Grey colour (26%) and Memphis Art Texture (26%). The second highest colour preference is Light Blue (20%). There are 12% of participants voted for Green, 8% for Yellow, and 6% for Orange. At the same time, the least colour preference goes for two colours: Red and Purple. Both get 1% of respondents chose as the most preferred colour.

Respondents say that the Grey colour always serves as psychologically neutral so people can easily find their way and this colour makes the space look wider. At the same time, they mentioned Memphis Art Texture on the corridor provides a more directional view to a patient unfamiliar with the hospital's layout and is said to be more attractive. In addition, the texture itself gives a fun and engaging atmosphere, reducing anxiety and creating a stimulating space.

### 4.2.4. Nurse Station

Nurse Station has the same common preference as the other area: Grey, 33%. Light Blue (23%) have been chosen as the second most preferred colour for Nurse Station. Also, 8% of participants chose Memphis Art Texture; 11% and 12% chose Yellow and Green, respectively. However, according to Figure 11, there is quite a balance in the rest of the colour choices, such as Purple (3%), Dark Blue (3%), Orange (3%) and Red (3%). In this area, at least each colour is voted as the most preferred colour.

For Nurse Station, most would choose Grey as the most preferred colour based on it providing calm and neutral. Pop colour has been selected balance throughout the respondent as it would signify a focal colour or a colour that

people can quickly notice when they need help. Most of the answers lead to a vibrant colour because it attracts the sight easily for those in need.

### 4.2.5. Doctor Consultation Room

Based on the result obtained in Figure 11, most respondents consider having a Green accent (23%) in Doctor Consultation Room. A subjective statement is given that the Green colour creates contrast with blood, which is unnatural to human aspects, allowing the doctors to focus on the patients psychologically. It is more to natural colours, added to be feeling more lively. Light Blue and Memphis Art Texture have the same colour preference, which is 20%. According to the 20% of respondents who chose Memphis Art, we can be concluded that applying fun elements to spaces of anxiety can provide relaxation, especially among children.

However, there is also a similar number of respondent who prefers other colours. For example, 15% of participants chose Grey colour while 12% chose Orange. The minority have chosen different colours, such as Yellow (6%), Dark Blue (2%) and Purple (1%). This result gives the consultation room a vast chance to be different from one another. Participants also believe that colour can soothe the patient while maintaining chill and relaxed environments to allow more open conversations between the doctors and the patients.

### 4.2.6. Patient 2-Bedded Ward

According to most respondents' results (in Figure11), the most preferred colour preference for the Ward is Light Blue (30%). While the second highest voted is 18%, Grey. Light Blue provide a calming and plain feeling as it is the same as Grey. The difference is that a slight tone of Blue can create a peaceful sight while resting for the patient compared to Grey, which is too neutral.

Therefore, Green and Memphis Art Texture have similar preference rates in this area, 17% and 14%, respectively. 8% of participants have selected Yellow and Purple as the preferred colour in this room. According to respondents' affective responses, these few brighter and more interesting colours can lighten up a patient's mood or decrease the anxiety among the patient and improve the recovery rate. Also, 4% of respondents chose Orange, and 1% selected Dark Blue. At the same time, no one chooses Red as the most preferred colour, which is also uncommon in standard Ward design.

### 4.2.7. Overall Result

At the beginning of the questionnaire, participants have an open question about colour's importance in a healthcare project. Three respondents disagreed that colour is essential in architectural components, applied explicitly in hospitals. However, after answering all the questionnaires and understanding different colours by comparing visuals of how colours affect the mood of each area. All respondents confirmed that colours are an essential element in architectural components and realised the changes and effects of applying colour accents in hospital exterior and interior. The respondent provides opinions such as visual is the first impression we have of the surrounding and how colours affect a patient's mood in places like the hospital. Some colours are commonly used in hospital or medical field architecture, which causes the mainstream preference among the respondent, such as Grey and Light Blue accent.

However, using different visual presentations shows subjective preferences on colours like Red, Green, Yellow, Purple and Textured Graphics as an accent in the hospital. However, these colours will be overshadowed by the common preference. The majority choose the Grey and Light Blue accent because it provides a more neutral mood and soothing feel to the patient, rather than a vibrant and vivid colour group that might cause anxiety to the patient. In addition, patients prefer a subtle mood to balance their emotions and reduce anxiety and nervousness while entering a hospital. In the end, all respondents understand the usage of colour in the psychological impression of architecture.

## 5. CONCLUSION

In a nutshell, colours have always played a significant role in human evolution. They are essential to our world's natural and architectural environments: the brain interprets and decides what it perceives as an objective and subjective such as the surrounding and colours. Our interpretation of colours includes psychological influence, visual communications, information conveyed, and emotional effect. Therefore,

proven that colour in architecture and design does not only benefits in aesthetic. The mood and ambience supporting the utilization of space is created by the characteristic of colours and message conveyed.

As for the healthcare environment and healing of patience, when a patient or his companion enters the hospital, the more significant part of the room, either a wall or the ceiling, is the first thing they notice. According to Forbes, lighter-coloured walls have been shown to make people feel accepted, while medium-coloured walls help to build trust. Brown was also discovered to be a colour that adds sophistication and provides a soothing option for potential patients. Colours have been shown to affect human emotion psychologically and affecting their mental state, whether at home, in the hospital, or in any other setting. Colours can speed up healing, lift spirits, and calm nerves. They can influence human behaviour in a closed space while making the room appear larger and more sophisticated.

### 5.1. Recommendations for further research

This study has evaluated the effects on the exterior and interior of a healthcare project and studied the relation between colour changes and users' affective responses. The researchers can study the light variables and colour changes for future studies. Furthermore, this study was restricted to nine main colour variables and six types of certain healthcare facility areas. In further studies, the selection of colours and rooms could be more variable. Lastly, this study mainly focuses on the public or patient reaction toward certain. Future investigations would do well for the healthcare worker to improve the work productivity and overall environment design in healthcare projects.

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