

Colour semantics in residential interior architecture on different interior types

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Abstract

Colour meaning is a challenging decision in interior architecture during the design process; however, specific meanings within different interior types have not yet been investigated. This study explored colour meaning in the context of residential interior types (eg, bedroom) under controlled conditions using 42 Munsell colours varying in hues, value, and chroma levels, with 14 adjectives (eg, comfortable, pleasant). The results demonstrate that some colours convey the same meanings (eg, vulgar) regardless of type of room; however, others (eg, beautiful) tend to require more complicated and sophisticated colour applications in different residential interiors. The study findings proved that colour meaning in RITs can be affected by all colour attributes. All colours that are named orange and red are selected for both negative and positive meanings. Colours that are named purple are selected less and only for negative connotations. The findings present an overall colour meaning guide for these residential interior types, which will be beneficial for decision makers (interior architects, designers, users) and colour researchers.

KEYWORDS

architecture, colour, interior, meaning, residential

1 | INTRODUCTION

Colour, as an embedded property of each surface in everyday life, and its attributes (hue, value, and chroma) are universally the same; however, their meanings can be diverse in different contexts. It is definite that colour has an influence on perception.¹ Surface colours affect our understanding and perception of very wide range of artefacts: artworks,² design objects,³ interiors,⁴ cities,⁵ etc. Colour, as a surface property, makes a significant contribution to the experience of these artefacts, especially in interior architecture. Decision makers, such as interior architects, designers, architects, and users (in residential interiors), have an intuitive connection with the typologies of a space

and how to colour it. However, a more solid colour chart including detailed information about colour attributes needs to be provided for them to use while designing and fulfilling the clients'/users' needs in interior spaces. Thus, this study is focuses on providing an overall colour chart for clarifying colour semantics in residential interior types (RITs) for decision makers and future researchers.

Smith⁶ reported the importance of colour in man-made environments in the context of meaning and experience by exploring the colour, person, and environment relationship. The colour combinations in man-made environments, especially in interiors, "become important in the formation of the identity and impression of that interior for the viewer, also as people move in interiors and surrounded by its

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surfaces, volume and scale, their experiences are influenced by the impact of colour interaction⁶ (p. 4). Effects of colours and their reflection on our everyday life have been investigated for decades by scientists, designers, and researchers from many different disciplines such as design, architecture, psychology, etc. As Acking and Küller¹ demonstrated, colour is a basic factor of human perception, which can be and should be studied in order to understand how this factor influences perception of a built environment totally. The previous study proved that colour experience in design disciplines is context dependent and where or how they are used to affect preference, experience, and perception.⁷ In other words, colour “is not a constant quality belonging to the object but something that varies depending on the specific viewing” situation⁸ (p. 23). The fact is that we have an inherent natural reason for different colour preferences on different surfaces; we might appreciate a bright red for a foundation pen as a product, but the same bright red colour on our bedroom walls might have negative connotations and meanings: being catastrophic or arousing feeling of danger; therefore, it is not preferred. Slatter and Whitfield⁹ (p. 1068) and Taft¹⁰ (p. 41) mentioned another earlier study¹¹ in Japan, which proves that building type (such as hospitals) and room function (eg, wards of hospital) affect colour preference. In a very recent colour preference study, Van der Voordt et al¹² explored four different interior space types (workspace: office and meeting room and residential: living room and bedroom) in two interior typologies (workspace and residential) and found white to be the most preferred colour for all interiors, and brown (in a living room) is the only colour that was preferred by more than 10% of participants. There might be similarities and differences in colour applications in different interior typologies (eg, public space, residential spaces) and different interior types in those spaces (eg, meeting room and office interiors in workspace typologies as explored by Van der Voordt et al¹²). Previous studies indicated that colour preferences show differences according to various interior types; thus, this study tries to examine the association between different RITs and colour meaning connotations.

Colour meaning has been studied by many researchers who are successful in their own respective fields; however, unfortunately, there is a risk of misunderstanding colour meaning studies as an underrated topic. Thus, the current study focuses on clarifying colour meanings in RITs scientifically in order to minimize misunderstandings between clients/users and designers during decision-making processes, which can be misguided by unscientific guidelines. Spörrle and Stich¹³ mentioned that there is a lack of scientific research on the bedroom where we spend a third of our lives, and they conducted an experimental study to investigate user-door-bed configurations in bedrooms in the context of an evolutionary need of a safe place to sleep.

Colour might affect that feeling of safety through their meanings, which can be a future aspect of colour semantics that definitely needs further research (semantics can be defined as the meaning and/or relationships of meanings <https://www.merriam-webster.com/dictionary/semantics>).

Semantic aspects of colours in interior architecture were investigated in relation to emotions: Red is associated with disgust and happiness, green is related to happiness, and blue is considered neutral on living room walls.¹⁴ As Lee, Park and Lee¹⁵ (p. 2) summarized in their recent study, “red induces feelings of excitement, tension, unpleasantness, anxiety, anger and warmth; green evokes feelings of comfort and stability; blue induces feelings of comfort, stability and coolness; and yellow evokes feelings of warmth”. Another recent study investigated free associations of wall colours without assigning any typology and revealed that red is related to warm and strong feelings, whereas green is associated with calm and home.¹⁶ Zhang, Han, Martin, and Zhang¹⁷ conducted an experimental study through the web to generate a framework that will improve 3D scenes semantically, and they used ‘girl’ and ‘boy’ as keywords in bedroom and ‘modern’ and ‘romantic’ in a living room. Their study demonstrates that girls’ bedrooms have more ‘pinkish’ colours, whereas boys’ bedrooms have ‘bluish’ colours, and a ‘romantic’ living room has more colours than a ‘modern’ living room. Kaya and Crosby¹⁸ explored colour preference and building types (residences, restaurants, religious buildings, hospitals, hotels, shopping malls, educational buildings, entertainment buildings, official buildings, and factory buildings) and found that preference is related to emotional associations, and those associations depend on their knowledge and experience with colour in their built environment. All three attributes of colour are related to residential buildings in terms of colour preference, and less-saturated and lighter colours were preferred more because they decrease arousal, which is not associated with a calming home atmosphere.¹⁸ Their results revealed that blue and red are mostly associated with residents because blue has a calming effect with its associations with tranquility and relaxation, whereas red reminds users of their past encounters with their own residential buildings: for their participants, it was red brick facades. In a similar vein, Lupton¹⁹ claims that, through experience, users generate meanings and associations that are more important than the event; thus, the success of a product depends on meaning more than its utilities. Users experience an interior and relate that interior to a meaning that becomes an essential part of their experience, and colours have fundamental effects on interiors because they convey those meanings. In addition, it should be noted that “human visual experience is spatial and holistic, dynamic and contextual. Neither colour nor

light nor any other visual quality can be seen and experienced in isolation, as a single and unrelated phenomenon – on the contrary, visual experience is always one and undivided”²⁰ (pp. 46, 47).

Hutchings et al²¹ (p. 45) provided a theoretical framework for the study by indicating that “expectations arise as a result of our interpretation of the perceived product or scene and most of our understanding of the scene arises from our visually perceived properties of the scene”. Users’ understanding of any RIT depends on their interpretation of design components and their materiality, and as Hutchings et al²¹ stated, walls are a design component of interiors through their colours. Users look at those components and interpret their own meanings based on their knowledge and experiences. Kaya and Crosby¹⁸ proved colour associations based on past encounters, and Lupton¹⁹ claimed that meaning and associations are created through experiences. Therefore, in order to collect colour associations and meanings, participants need to recall their memories and engage with their knowledge. This study tries to provide a colour chart for RITs by connoting interior-specific meanings with different attributes of colour by hypothesizing that some colours will be associated with a meaning regardless of RITs; however, some colour-meaning connotations will vary in different RITs. The importance of this study’s findings will clarify the main challenge in design processes about misunderstandings in colour meaning between designers and clients/users, which will be beneficial for both decision makers and end users.

Interiors have been changing and becoming more visually intriguing by each decade. Every day, we have more options and more interior design elements; however, neither designers nor users are equipped to use the vast number of options. In addition, interior architects and designers become more research active and are looking for reliable sources for their design process now more than ever. Therefore, interior architects need comprehensive research studies in order to analyze and synthesize their design projects and their audience to offer a fulfilling interior experience. An early study⁹ (p. 1070) on residential interiors explored living room and bedroom colour appropriateness and concluded that “the judged appropriateness of colour varies according to the function of a room”. Walls are the background of life since the beginning of humanity (as people started to live in caves); however, they have been varied throughout history, from very visually burdened styles to the very brutal style of Adolf Loos.²² Interior surfaces with their colours have effects on user experience in interiors. Nonetheless, it is well-established knowledge both in design disciplines and in public awareness; research studies on colour semantics in interiors are rare and need more in-depth

investigation. There is a gap in the literature regarding how semantic aspects of colours on interior surfaces are changing according to interior typologies and different interior space types within a specific interior typology depending on their functions. The function of a space and the function of colour are inseparable in decision-making processes. As Smith²³ demonstrated, users judge the function of the interior spaces according to their created atmospheres by designers, and one of the dominant factors that create an atmosphere is colour. Therefore, this study aims to reveal the colour meaning of different interior space types in residential private spaces (also known as residential interiors as an interior typology) by providing the overall colour chart for RITs for decision makers to fulfil their clients’/users’ needs and future researchers to investigate further aspects of colour semantics in interior architecture.

2 | METHOD

2.1 | Present study

The aim of the present study was to investigate colour meanings in different RITs. For this purpose, an experimental study was conducted under controlled conditions. There are significant relationships between residential building and all three attributes of colour.¹⁸ Therefore, in this study, 42 chromatic colours were used as stimuli with a variety of hue, value, and chroma levels, similar to Kaya and Crosby,¹⁸ thus equally covering different hues, values, and chromas in the Munsell Book of Colour. Van der Voordt et al¹² revealed that the most preferred colour in workspaces is white and discussed that habituation or stereotype can cause this preference. Regarding residential interiors, white or whitish colours are used more than others; therefore, in order to avoid habituation and stereotypes, achromatic colours are excluded. A pilot study was conducted in which participants stated that writing Munsell codes takes a long time; therefore, Munsell codes were converted into numeric codes (such as 1, 2, 3, etc.). The responses of three participants in the pilot study were included in the dataset. Colours were presented in the same configuration as Table 1, without colour names and Munsell codes but with numeric codes (in parenthesis), where 5YR 3/6 was 1, 5YR 7/14 was 2, and so on. Residential interiors as homes are inherently linked to comfort and pleasantness. In this experimental study, the meaning of comfort (comfortable-uncomfortable) and pleasantness (pleasant-unpleasant) for RITs was investigated with five opposite adjectives, which had been investigated by Charles Taft¹⁰ in his elaborative colour study.

TABLE 1 Munsell codes of the colour that were presented to the participants (their conversions into numeric codes are presented in bold)

Orange	Red	Green	Purple	Blue	Yellow
5YR 3/6 (1)	2.5R 6/8 (8)	2.5G 9/4 (15)	10PB 4/12 (22)	7.5PB 6/10 (29)	7.5Y 8.5/12 (36)
5YR 7/14 (2)	2.5R 7/8 (9)	2.5G 5/8 (16)	10PB 4/10 (23)	7.5PB 5/10 (30)	7.5Y 8/8 (37)
5YR 7/10 (3)	2.5R 5/14 (10)	2.5G 5/2 (17)	10PB 3/10 (24)	7.5PB 6/8 (31)	7.5Y 8.5/8 (38)
5YR 7/6 (4)	2.5R 5/4 (11)	2.5G 7/4 (18)	10PB 3/6 (25)	7.5PB 4/12 (32)	7.5Y 6/8 (39)
5YR 5/6 (5)	2.5R 5/8 (12)	2.5G 5/4 (19)	10PB 5/10 (26)	7.5PB 4/6 (33)	7.5Y 9/4 (40)
5YR 7/4 (6)	2.5R 4/10 (13)	2.5G 6/10 (20)	10PB 6/10 (27)	7.5PB 4/8 (34)	7.5Y 7/8 (41)
5YR 6/12 (7)	2.5R 6/12 (14)	2.5G 8/8 (21)	10 PB 5/6 (28)	7.5PB 6/6 (35)	7.5Y 6/4 (42)

Residential interiors have several interior types that are mostly universal, such as the bedroom; however, there are some cultural differences. Therefore, all interior types that might be utilized in residential interiors in Turkey were included in the study. For example, balcony was included because it functions as a living room for some families as a semi-open space, especially during hot summers. Both the toilet and bathroom were included because some families prefer to use their bathroom, while their toilet is reserved for their guests. In a similar vein, some people work from home and therefore have separate workplaces in their homes with their embedded libraries for all residents (their partners, children, siblings, etc.), which are called workroom.

2.2 | Participants

The experiment was conducted in Turkish with 20 volunteers of an average age of 26 years and who have a good command of Turkish. The sample group seemed few in number, but each volunteer was interested and could represent both decision makers (as they have knowledge about colour) and the target group (as they have unique perspectives as residential interior users). They had been living in Ankara for at least over 2 years and are interested in colour studies, which provided very sensitive participants who were willing to spend their time on thinking about colour. Snowball sampling was used to invite participants²⁴ from the Interior Architecture and Environmental Design and Architecture (Arch.) departments in a university. Participants did not receive any payment or encouragement. That provided a group of 20 individuals (16 females and 4 males) considering the previous study¹⁴ revealed no gender difference in colour emotions for living rooms. As they needed to recall memories and engage with their knowledge, they needed to spend a very long time on each response to colour associations. Average experiment duration was 53 minutes

(minimum: 35 minutes, maximum: 89 minutes). Participants who are particularly interested in colour studies were selected due to their interest on the topic to avoid experimental mortality, which occurs when participants do not continue the experiment²⁴ due to the long duration of the experimental process. Snowball sampling also guaranteed a volunteer participant group that pays attention and completes the experiment not because of peer pressure or social pressure but because of the group members' own interests. Participants responded to both single and paired colours on RITs' walls in order to ensure a comparable dataset, which was obtained using the same group of participants. Participants self-stated that they were not colour-blind and asked to use their corrective lenses, if necessary, during the experiment.

2.3 | Experimental conditions

Each participant read an information form and signed a consent form before the experiment. Participants were asked to write the numeric codes of colours that they related to each adjective for different types of interiors as a wall colour using 42 colour chips, which represent different attributes of colour in the Munsell Book of Colour. They answered demographic questions and selected associated colours under controlled conditions in a viewing box, with 480 lux (average illuminance in the box was measured with Konica Minolta T-1 Illuminance Meter, which has a range of 0.01 to 99 900 lux), in an experiment room without any window (please see Figures 1 and 2). As interior lighting has significant effect on colour viewing,²⁵ and the study was focused only on colour, the lighting conditions were kept under control during the experiment. Osram Duluxstar Mini Twist 13w 865 was used with 6500 K colour temperature and a colour rendering index that is higher than 80, which fulfilled all the technical requirements for distinguishing the best colours. Then, participants wrote down another two



FIGURE 1 Experimental conditions

colours as a pair that they associated with each adjective for the same interior types using the same colour chips. Single colours and paired colours were entered into two separate sheets. There was no limitation to selecting the same colour for 14 adjectives, 10 RITs, and/or for both single and paired colours. In this study, participants were asked to select wall colours for 10 RITs with different functions: entrance, living room, corridors, kitchen/ dining room, toilet, work room, balcony, bathroom, kid's room, and bedroom.

3 | RESULTS AND DISCUSSION

The data were analyzed with IBM's SPSS Statistics 26 through a Frequency Test. In order to present a unified and concise scene, Table 2 demonstrates colour names, and Table 3 presents the most frequent colours (with their percentages) for each RIT, with 12 colours that were not selected on 14 semantic adjectives. The results of colour pairs are not presented in this study. Single colour results provide a promising pallet of colours and their associations, in addition to an insightful comparison of different meanings. Colour codes that were selected less than 15% are not included (Table 3). Results also compile a list of 'neutral' colours that were not selected by participants. These colours might have neither a positive nor negative effect on colour connotations. In interior architecture, decision makers need to create neutral backgrounds in order to underscore other design components, for which these 12 colours can be used.

They have neither a high nor low value level and are mostly saturated colours, which can be interpreted as there being a tendency for high saturated colours with a moderate value level to create better neutral backgrounds. Participants mentioned 'entrance'—'corridor' and 'toilet'—'bathroom' having similar colour associations during the experimental study. These results indicated that, although they are mostly associated with the same or similar colours, there can be differences in either hue or value or chroma for these interiors (Table 3). For example, bathroom and toilet share a similar colour chart for RITs; however, they have two different colours that mean beautiful. Similarly, entrance and corridor share mostly the same colours; however, for pleasant and comfortable meanings, they are associated with different colours.

There is no effect of interior types on colour meaning for 'discreet' and vulgar'. Moreover, 'loud', 'ugly', 'unpleasant', and 'uncomfortable' have the same colour for all RITs with a few exceptions. That proves that a colour can be associated with the same meanings in different RITs. For 'discreet' and 'vulgar', 7.5Y 9/4 (yellow) and 5YR 3/6 (orange) were selected for all RITs, respectively. Regardless of RITs, these two colours are not used to create appealing effects. Based on these results, '7.5Y 9/4' (yellow) related to 'discreet', which corresponds with the previous study¹⁰ that showed beige is related to discreet in product design. There are very high frequency rates for 10 colour meanings for RITs, which refer to high agreement (Table 3). 5YR 3/6 (orange) was constantly selected for negative meanings, such as vulgar, ugly,

Demographic Questions:

Name- Surname: _____ Year of Birth: _____ Place of Birth: _____ Residence Location: _____

Education Level: _____ Your Job or Your University Department: _____

Gender: Female Male Other

Do you have any visual impairment (myopia, hyperopia, etc.)?
 If you have a visual impairment, please wear corrective equipment such as glasses and lenses during the experiment!

Are you colour blind? Yes No

For the adjectives below, please write the **COLOUR** for the **WALLS** that you associate with the specified interior types. You can use the same colour multiple times.

	Entrance	Living Room	Corridors	Kitchen/ Dining Room	Toilet	Work Room	Balcony	Bathroom	Kid's Room	Bedroom
Comfortable										
Uncomfortable										
Pleasant										
Unpleasant										
Beautiful										
Ugly										
Elegant										
Vulgar										
Loud										
Discreet										
Masculine										
Feminine										
Warm										
Cold										

For the adjectives below, please write the **COLOUR PAIRS** for the **WALLS** that that you associate with the specified interior types. You can rewrite the colours you wrote earlier, and you can use the same colour pair multiple times, please be sure to write different colours for each pair.

	Entrance	Living Room	Corridors	Kitchen/ Dining Room	Toilet	Work Room	Balcony	Bathroom	Kid's Room	Bedroom
Comfortable										
Uncomfortable										
Pleasant										
Unpleasant										
Beautiful										
Ugly										
Elegant										
Vulgar										
Loud										
Discreet										
Masculine										
Feminine										
Warm										
Cold										

FIGURE 2 The questionnaire

TABLE 2 Comparison of colour names with the previous study (the colour names presented in bold are the current study's findings which agree with the previous study)¹³

Adjectives	Taft, 1997	Result of current study
Cold	Turquoise, chartreuse	Blue, green , yellow, purple
Warm	Red, orange, brown	Orange, red
Feminine	Pink	Red , orange
Masculine	Grey, brown, blue	Blue , green, purple, orange
Discreet	Grey, beige, blue, brown	Yellow
Loud	Orange, yellow, chartreuse	Orange, yellow
Vulgar	Chartreuse, orange, yellow	Orange
Elegant	Red, blue	Orange, red , yellow, green
Ugly	Orange, chartreuse, brown	Orange , purple, red
Beautiful	Red, blue	Green, yellow, red, blue , orange
Unpleasant	NA	Orange, green, purple, yellow, red
Pleasant	NA	Green, orange, yellow, red
Uncomfortable	NA	Orange, red, yellow
Comfortable	NA	Orange, yellow, red

TABLE 3 The highest frequency for single colour in each interior type (frequency and percentage in parenthesis) (colours are representative and are generated from Munsell samples' photos) (in colour)

	cold	warm	feminine	masculine	discreet	loud	vulgar	elegant	ugly	beautiful	unpleasant	pleasant	uncomfortable	comfortable
Entrance	15 (6 30%) 	2, 3 (4 20%) 	9 (7 35%) 	1 (5 25%) 	40 (10 50%) 	2 (8 40%) 	1 (10 50%) 	6 (7 35%) 	1 (5 25%) 	15 (4 20%) 	1, 2, 15 (3 15%) 	4, 15, 18 (3 15%) 	1 (4 20%) 	4 (4 20%)
Corridors	15, 35 (4 20%) 	3 (5 25%) 	9 (5 25%) 	1, 33 (4 20%) 	40 (11 55%) 	2 (5 25%) 	1 (8 40%) 	6 (4 20%) 	1 (7 35%) 	15, 40 (4 20%) 	1 (4 20%) 	40 (3 15%) 	1 (4 20%) 	40 (5 25%)
Living Room	15 (6 30%) 	3 (3 15%) 	8 (5 25%) 	1 (5 25%) 	40 (8 40%) 	2 (7 35%) 	1 (10 50%) 	6 (5 25%) 	1, 5, 11, 24, 25 (2 10%) 	17 (3 15%) 	1, 2, 5, 15, 24, 39 (2 10%) 	6 (4 20%) 	1 (3 15%) 	6, 40 (3 15%)
Kitchen/ Dining Room	31 (4 20%) 	3 (3, 15%) 	14 (4, 20%) 	1, 33, 34 (3, 15%) 	40 (8 40%) 	2 (8 40%) 	1 (8 40%) 	11 (5 25%) 	1, 2 (5 25%) 	17 (4 20%) 	1 (5 25%) 	4 (3 15%) 	1 (6 30%) 	4 (4 20%)
Balcony	40 (4 20%) 	3 (5 25%) 	8 (5 25%) 	33 (4 20%) 	40 (11 55%) 	2 (6 30%) 	1 (8 40%) 	40 (6 30%) 	1 (5 25%) 	11, 40, 42 (3 15%) 	1, 10 (3 15%) 	40 (4 20%) 	1 (3 15%) 	40 (5 25%)

unpleasant, uncomfortable, and masculine. Because, as a stereotype, residential interiors are misinterpreted as feminine spaces, being 'masculine' might be perceived as a negative characteristic. For 'vulgar', there is a 75% of

agreement for the kid's bedroom on 5YR 3/6 (orange), which reveals that the colour has a negative meaning in residential interiors and should not be preferred by decision makers. In a similar vein, with very high agreement,

TABLE 4 The highest frequency for single colour in each interior type with their Munsell Colour codes (colours are used for representative purposes and solely present hues, not value and chroma; yellow is represented by black to provide legibility) (in colour)

	cold	warm	feminine	masculine	discreet	loud	vulgar	elegant	ugly	beautiful	unpleasant	pleasant	uncomfortable	comfortable
Toilet	30, 31, 35 (3 15%) 	4, 7 (3 15%) 	12 (4 20%) 	32 (5 25%) 	40 (10 50%) 	2 (4 20%) 	1 (7 35%) 	6, 15, 40 (3 15%) 	1 (5 25%) 	35 (3 15%) 	5 (3 15%) 	15 (4 20%) 	2, 13 (3 15%) 	40 (4 20%)
Work room	17, 31, 40 (3 15%) 	4, 11 (4 20%) 	6, 11 (3 15%) 	17, 33, 34 (3 15%) 	40 (8 40%) 	2 (5 25%) 	1 (8 40%) 	6 (4 20%) 	1 (5 25%) 	6, 15 (3 15%) 	1 (6 30%) 	6 (4 20%) 	2 (6 30%) 	4 (5 25%)
Bathroom	35 (4 20%) 	4 (4 20%) 	8 (5 25%) 	32, 33 (4 20%) 	40 (10 50%) 	2, 36 (3 15%) 	1 (7 35%) 	6 (5 25%) 	1 (4 20%) 	40 (4 20%) 	1 (4 20%) 	15 (4 20%) 	1, 2 (4 20%) 	40 (4 20%)
Kid's room	15 (5 25%) 	2 (4 20%) 	9 (7 35%) 	25, 30 (3 15%) 	40 (8 40%) 	2 (6 30%) 	1 (15 75%) 	40 (4 20%) 	1 (7 35%) 	18 (3 15%) 	1 (9 45%) 	15 (3 15%) 	1 (6 30%) 	6 (3 15%)
Bedroom	27, 31, 40 (3 15%) 	11 (5 25%) 	10, 11, 13 (4 20%) 	32, 33, 34 (3 15%) 	40 (8 40%) 	2 (7 35%) 	1 (8 40%) 	11 (5 25%) 	1 (7 35%) 	11 (5 25%) 	1 (5 25%) 	11 (7 35%) 	36 (7 35%) 	11 (5 25%)
Non-picked colours for all scales	16 (2.5G 5/8), 19 (2.5G 5/4), 20 (2.5G 6/10), 21 (2.5G 8/8), 22 (10PB 4/12), 23 (10PB 4/10), 26 (10PB 5/10), 28 (10PB 5/6), 29 (7.5PB 6/10), 37 (7.5Y 8/8), 38 (7.5Y 8.5/8), 41 (7.5Y 7/8) 													

5YR 7/14 (orange) is related to ‘loud’, and that might refer to negative meanings. Being loud can be associated with arousal and irritability, which contradicts the calming and relaxing nature of residential interiors as quiet shelters from the outside world. Moreover, the same colour is associated with ‘ugly’ in kitchen/dining room; ‘unpleasant’ in living room; and ‘uncomfortable’ in toilet, workroom, and bedroom. Results proved that colour meaning might vary in RITs (Table 4). The study demonstrates that colour association of negative meanings vary less in RITs; however, positive meanings require more a rigorous decision-making process as a challenge for appealing residential interiors. By avoiding those negative colours, decision makers can ensure fewer negative connotations through interior walls.

All orange and red colours were selected, which can be interpreted as them being outstanding and noticeable. The previous study¹² stated that ‘brown’ is preferred in living rooms prominently more than others. In this study, brownish colours have fewer positive meanings in living room. This difference might be due to methodology; in this study, 42 colours are presented where the previous study used colour names without samples. On the other hand, purple colours were selected less than others. Purple appears in frequency results four times: for living room ‘ugly’ and ‘unpleasant’ meanings, for bedroom ‘cold’ meaning, and for kid’s room ‘masculine’ meaning: except masculine, the adjectives convey negative

meanings. Nonetheless, being masculine in a kid’s room might be misconstrued as a negative meaning as well. A previous study¹⁸ revealed that purple is the least favorite colour in residential building types, which corresponds to the present study’s findings. Purple colours can be interpreted to convey negative meaning more than other colours and are thus preferred less in residential building types. In contrast with the previous study,¹⁸ except ‘beautiful’ in toilet, blues were selected for ‘cold’ and ‘masculine’ adjectives. The previous study explored colour preference in different building types; however, the current study asked for colour meaning in specific RITs. However, preference can be related to meaning, building types, and RITs and might arouse different associations in terms of colour connotations. Alternatively, embracing different methodologies might cause this discrepancy between the two studies’ results. An earlier study²⁶ (p. 394) ascertains that: “Blue, blue-green, green, red-purple, purple, and purple-blue were the most pleasant hues, whereas yellow and green-yellow were the least pleasant.” In this study, the results show that yellow colours can be assessed as ‘pleasant’ in corridors and balcony as long as they have a high value and moderate level of chroma. Similarly, participants selected orange with low value and moderate level of chroma for ‘unpleasant’ meaning instead of yellows. Differences between the two studies might be due to different methodologies and different contexts; in fact, this earlier study did not explore

colours in interiors. 'Ugly' colours in the study correspond with colour choices of 'masculine', 'vulgar' 'loud', and 'uncomfortable', whereas 'beautiful' corresponds with 'discreet', 'elegant', 'pleasant', and 'comfortable' (Tables 2, 3 and 4). It is interesting to note that 'beautiful' has the highest variety of hues, demonstrating that creating beautiful residential interiors requires a high complexity of hue applications. Cold hues and warm hues are associated with cold and warm, respectively, as suggested by literature.^{16,27-29} A previous study suggested that hue is related to warmth more than value and chroma.³⁰ Similarly, cold and warm adjectives have a variety of value and chroma levels, which indicates that hue has a stronger effect on these meanings than value and chroma in interiors.

Kaya and Crosby¹⁸ revealed that the colour preference on different building types (eg, residential buildings) are affected by all three attributes of colour as an early study suggested that colour emotions are affected as well.²⁶ Similarly, this study's findings reveal that the same hues might arouse very different meanings with different values and chroma levels ('comfortable' and 'uncomfortable' for entrance); thus, we can anticipate a relationship between colour meanings and RITs through all three attributes of colour (Tables 3 and 4). For instance, the same hue '5YR' was selected for both positive and negative connotations (eg, uncomfortable-comfort). Furthermore, vulgar and elegant share the same hue on different RITs, which proves that value and chroma have effects on colour semantics in RITs (Table 4). An earlier study mentioned that brightness and saturation have prominent effects on emotions, which can be related to colour meanings in interiors.²⁶ In the same vein, Kaya and Crosby¹⁸ mentioned that less saturated and lighter colours were preferred in residential building types more because they decrease arousal, which is not associated with a calming home atmosphere. The current study's findings concur with this previous study—that people associate discreet, elegant, beautiful, pleasant, and comfort to lighter and less saturated colours more compared to loud, vulgar, ugly, unpleasant, and uncomfortable (Table 4). Higher value and lower chroma provide a more elegant effect in several RITs such as living room, work room, bathroom (Tables 3 and 4). According to Taft,¹⁰ orange is the ugliest and loudest colour when it was assessed with colour chips on product types, which agrees with the current study's findings (Tables 2, 3, and 4). Nonetheless, orange with different value and chroma levels is selected for positive meanings as well, which supports the fact that colour meaning can vary in RITs depending on all colour attributes. Previous studies suggested that green colour in interiors has 'home' and 'calming' meanings¹⁶ and 'happiness' in living room.¹⁴ Similarly, in this study, green colours are selected for

'beautiful' and 'pleasant' for many RITs. On the other hand, green colours are selected for 'cold' and 'unpleasant' in entrance, living room, and corridors and for 'cold' in corridors and kids' room. Thus, as the same hue can convey different and opposite meanings in RITs, their value and chroma levels purport to affect semantic independently. Hence, simply generalized recommendations for colour semantics in websites/magazines without any reliable academic research should be avoided.

4 | CONCLUSION

Colour applications in interior architecture have been underscored by architects, designers, educators, and public; however, colours "are a standout amongst the most essential things encompassing us from style perspective, they can change point of view, control measurements, even inspire emotions if utilized right"³¹ (p. 523). Wall colours can be changed and renewed at a low cost and with high impact even if users/clients are living within them as colour is one of the ambient stressors that might affect an individual's physiology, motivation, behavior, and cognitive and social interactions.³² Changing and manipulating the meaning of interiors through colours are preferred because of practical and financial reasons. Their meanings in interiors are a question of interest, and this study is valid in this regard. The study aimed to explore how different wall colours can be associated with different meanings in RITs. It was hypothesized that some colour semantics tend to be same in all RITs; however, others will vary in different RITs. The results did not reject this and demonstrated that some colours have the same meanings regardless of RIT (eg, discreet), and others can vary depending on RITs, whereas some meanings require more sophisticated colour applications (eg, beautiful). The study presents a colour meaning chart for RITs that can be embraced as a design guide in both industry and academic studies. Using this, it is worth revealing that colour meaning might change in different RITs, and all colour attributes (hue, value, and chroma) might affect them; therefore, rigorous investigation is needed for each interior typology and each interior type within those interior typologies. The study reveals 12 colours that are neutral (neither negative nor positive association) for 14 meanings in RITs; thus, they can be preferred as a background colour to underscore other interior architecture elements. In addition, results suggest that decision makers should be careful to apply purple on RITs' walls.

Although gender shift universally affects users, residential interiors are stereotypically associated with more female features. Thus, in this study, the masculine

adjective might accompany negative meanings on residential wall colours. Authors personally encourage their students to create more gender equality in interiors by avoiding stereotypical associations such as implying women should be in the kitchen through colour choices, whereas both men and women can occupy the kitchen as long as they are willing to do so. Therefore, not only designers but also design educators are responsible to move past those stereotypes in interiors through interior architecture elements such as colour. As interior architects, designers, and design educators insist on using the same references for the gender issue, users inevitably keep believing their significance and necessity. An interior architect is responsible to his or her clients, users, and society in order to commit to satisfying their needs and preferences. Therefore, he or she should fulfil his or her commitment by creating sensitive and satisfactory interiors for the users based on their actual needs instead of what they believe they need.

Research studies in colour application are the only reliable sources for architects and designers in the industry; thus, future studies need to focus on different methodologies and interior typologies in order to reveal colour meanings in interiors. Compared to colour-adjective associations of Taft,¹⁰ there are some similarities indicating that some colour associations are very powerful, regardless of context. Despite these similar colour associations, differences between two studies call for further action on colour research in interior architecture discipline. Taft¹⁰ excluded only white because of technical reasons; similarly, this study enables comparison by excluding all achromatic colours due to methodological reasons. Future studies need to explore not only white but also other achromatic colours (such as gray, light gray, etc.), which are applied frequently to both public and residential interiors. However, not including achromatic colours in this study provided chromatic variety and encouraged participants to focus on colour meanings rather than giving a stereotyped response, such as white. The previous study¹² proved that users tend to prefer white, although its effects on mood, performance, and semantic are not nourishing.^{16,33-35} As discussed above, people can prefer colour for different reasons such as stereotypes, habitation, culture, etc. without considering its effects on themselves in the short and long terms. However, interior architects and designers are responsible for colour effects in interiors and should avoid contaminating reasons (such as habitation) throughout the design process.

With the current study, the number of studies in colour applications in residential interiors will be increased. Because residential interiors have not been appreciated as a serious topic in interior architecture, these important design decisions are based on the basis

of hearsay. Covid-19 reminds us of the significant roles of residential interiors: shelter, home, asylum, etc. Nowadays, beside our governments,³⁶ social media calls for social distancing through 'stay home' hashtags and raises awareness of residential interiors that are functioning as an office, a gym, a coffee shop, a pub, a library, retails, and so on. This study hopes to start a colour application guide in terms of interior architecture that will present colour meaning with preference and emotions; therefore, future studies need to delve into these aspects of RITs in addition to elaborative colour meaning explorations.

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REFERENCES

- [1] Acking BC, Küller H. The perception of an interior as a function of its colour. *Ergonomics*. 1972;15(6):645-654.
- [2] Itten J. *The Elements of Color*. Canada: John Wiley and Sons; 1970.
- [3] Fenko A, Schifferstein HN, Hekkert P. Looking hot or feeling hot: What determines the product experience of warmth? *Mater Design*. 2010;31(3):1325-1331.
- [4] Park Y, Guerin DA. Meaning and preference of interior color palettes among four cultures. *J Interior Design*. 2002;28(1):27-39.
- [5] Sarica C, Cubukcu E. Evaluating color combinations using abstract graphics versus pictures of simulated urban settings. *AI Z ITU J Fac Archit*. 2018;15(1):123-134.
- [6] Smith D. Color-person-environment relationships. *Color Res Appl*. 2008;33(4):312-319.
- [7] Kauppinen-Räisänen H, Luomala HT. Exploring consumers' product-specific colour meanings. *Qual Market Res Int J*. 2010;13(3):287-308.
- [8] Fridell Anter, K. (2000). What Colour is the Red House? Perceived Colour of Painted Facades [Doctoral dissertation]. Institutionen för arkitektur).
- [9] Slatter PE, Whitfield TW. Room function and appropriateness judgments of color. *Percept Motor Skills*. 1977;45(3_suppl):1068-1070.

- [10] Taft C. Color meaning and context: Comparisons of semantic ratings of colors on samples and objects. *Color Res. Appl.* 1997; 22(1):40-50.
- [11] Inui M. Practical Analysis of Interior Color Environment. Tokyo Building Research Institute, Occasional Report No. 27, 1966.
- [12] Van der Voordt T, Iris B, de Jan B. Color preferences for four different types of spaces. *Facilities.* 2017;35(3/4):155-169.
- [13] Spörrle M, Stich J. Sleeping in safe places: An experimental investigation of human sleeping place preferences from an evolutionary perspective. *Evol Psychol.* 2010;8(3): 147470491000800308.
- [14] Güneş E, Olguntürk N. Color-emotion associations in interiors. *Color Res. Appl.* 2020;45(1):129-141.
- [15] Lee H, Park J, Lee J. Comparison between psychological responses to 'object colour produced by paint colour' and 'object colour produced by light source'. *Indoor Built Environ.* 2020;1420326X19897109.
- [16] Ulusoy B, Olguntürk N. Understanding responses to materials and colors in interiors. *Color Res. Appl.* 2017;42(2): 261-272.
- [17] Zhang S, Han Z, Martin RR, Zhang H. Semantic 3D indoor scene enhancement using guide words. *Visual Computer.* 2017;33(6-8):925-935.
- [18] Kaya N, Crosby M. Color associations with different building types: An experimental study on American college students. *Color Res. Appl.* 2006;31(1):67-71.
- [19] Lupton E. *Design is storytelling*. Smithsonian Design Museum New York: Cooper Hewitt; 2017.
- [20] Arnkil H, Fridell Anter K, Klarén U. *Colour and Light: Concepts and Confusions*. Helsinki: Aalto University; 2012.
- [21] Hutchings JB, Ou LC, Ronnier LM. Quantification of scene appearance—A valid design tool? *Color Res. Appl.* 2012;37(1): 44-52.
- [22] Loos A. *The Principle of Cladding. Spoken into the Void: Collected Essays*. Vol 1900. Cambridge, MA: The MIT Press; 1897: 66-69.
- [23] Smith D. Architectural Experience: A Composition of Viewpoints [PhD]. Brisbane: Queensland University of Technology; 2000.
- [24] Neuman LW. *Social Research Methods: Qualitative and Quantitative Approaches*. London: Pearson; 2010.
- [25] Yu H, Akita T. The effect of illuminance and correlated colour temperature on perceived comfort according to reading behaviour in a capsule hotel. *Build Environ.* 2019;148: 384-393.
- [26] Valdez P, Mehrabian A. Effects of color on emotions. *J Exp Psychol.* 1994;123:394-409.
- [27] Wastiels L, Schifferstein HN, Heylighen A, Wouters I. Red or rough, what makes materials warmer? *Mater Design.* 2012;42: 441-449.
- [28] Newhall SM. Warmth and coolness of colors. *Psychol Record.* 1941;4:198-212.
- [29] Wright B. The influence of hue, lightness, and saturation on apparent warmth and weight. *Am J Psychol.* 1962;75(2): 232-241.
- [30] Hogg J. A principal components analysis of semantic differential judgements of single colors and color pairs. *J General Psychol.* 1969;80(1):129-140.
- [31] Radwan AH. Color in architecture is it just an aesthetic value or a true human need? *Int J Eng Res Technol.* 2015;4: 523-533.
- [32] Kwallek N, Soon K, Woodson H, Alexander JL. Effect of color schemes and environmental sensitivity on job satisfaction and perceived performance. *Percept Motor Skills.* 2005;101(2): 473-486.
- [33] Kwallek N, Lewis CM, Lin-Hsiao JWD, Woodson H. Effects of nine monochromatic office interior colors on clerical tasks and worker mood. *Color Res. Appl.* 1996;21(6):448-458.
- [34] Kwallek N, Woodson H, Lewis CM, Sales C. Impact of three interior color schemes on worker mood and performance relative to individual environmental sensitivity. *Color Res. Appl.* 1997;22(2):121-132.
- [35] Küller R, Mikellides B, Janssens J. Color, arousal, and performance—A comparison of three experiments. *Color Res. Appl.* 2009;34(2):141-152.
- [36] Guidance: Staying at home and away from others (social distancing). <https://www.gov.uk/government/publications/full-guidance-on-staying-at-home-and-away-from-others/full-guidance-on-staying-at-home-and-away-from-others>. Updated March 29, 2020. Accessed April 05, 2020, 02:18.

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