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A Study of the Factors Affecting Colour Meaning and Emotional Response

Reham Sanad ^{a*}, Al Zahra College for Women, Muscat 3365, Oman.

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Abstract

Colour design research studies are concerned with identifying colour preferences and emotion elicited by colours, and a deep understanding of the aspects shaping these emotions will lead to better exploitation of colour design. This study highlights the aspects that contribute to human emotional response to colour. Hue, brightness and chroma are colour attributes used in different colour model identifying colours. Brightness and chroma in most studies affect the hue on colour emotion association. Colour context, texture and size are also discussed in terms of contribution to colour motion response. Other factors such as time span and culture impact the colour emotion link and aspects related to humans including personality, age, gender and preference to colour and/or emotion are discussed. The findings of this research will benefit marketers and designers to understand the effective usage of colour in design making in its aesthetical and functional aspects.

Keywords: Colour attributes, age, sex, preference, culture, context, education, religion, personality, colour context.

* ADDRESS FOR CORRESPONDENCE: **Reham Sanad**, Al Zahra College for Women, Muscat 3365, Oman.
E-mail address: sdrs@leeds.ac.uk / Tel.: 00968-24512888

1. Introduction

Colour is defined as the property possessed by an object producing different sensations on the eye as a result of the way it reflects or emits light (Oxford University Press, 2017). It is one of the visual art elements having aesthetic appeal. Each colour has its own significant meaning and would be used in design to symbolise an object, function or process. It sets up our mood, emotions, feelings and state of mind. Colour plays an important role in human life depicting and shaping our lives in terms of social, psychological, political and economic aspects.

Designers in different fields set colour schemes in order to communicate with consumer or audience and give a design certain features. A consumer's decision is based on his reaction and response to colour design because of its emotional effect. This reaction to colour is called colour emotion. Different colours evoke various emotional feelings such as excitement, energy and calm.

Synaesthesia is defined as a condition in which one type of stimulation evokes the sensation of another. Since colour and emotions are two items from different domains, therefore, it is important to explain where colour synaesthesia comes from or how associations between emotions and sense perceptions (due to colour perception), such as warm and heavy, are established.

The process of responding to or perceiving colour producing a colour emotion consists of and based on three main elements. These are colour attributes, respondent experience of perceived colour and the environment in which a colour is perceived. From previous research studies, it was found that a colour could be associated with several different emotions and an emotion could be associated with different colours (Saito, 1996). Several research studies were carried out investigating colour preference and its connection with emotions.

According to Frank (1976) and Levy (1980), the psychological basis for understanding colour in terms of colour emotion association is not clear (Frank, 1976; Levy, 1980). It is believed that this relationship is complex because of different factors having a role in this relationship (Adler, 2017). Since then, there were attempts by researchers to establish these relationships. Therefore, it was decided to carry out the present study aiming at explaining the relationship between colours and emotions on the basis of respondent's reaction (Terwogt & Hoeksma, 1995).

The purpose of this study was to highlight the factors affecting colour-emotion associations. Comparisons between studies investigating sociological, biological and cultural impacts carried out were conducted. This is in order to find the most important impacts affecting colour-emotion associations.

The objectives of this study were to carry out a comprehensive literature review of the basis of colour-emotion association, find the factors affecting colour emotion association, identify the most affective factor in colour emotion (this could be the factor repeated or common in different studies from different respondents) and describe the relationship between these factors (i.e., colour attributes, personal experience, environmental and cultural circumstances) and emotional response induced.

This study is supportive for designers because – on one hand – researchers concerned with the basis of colour-emotion association (colour psychology) are mostly working in the field of psychology. On the other hand, design researchers interested in colour emotions are mostly investigating the emotions elicited by colours and preference. This is in order to apply and exploit these emotions in consumer and audience decision towards a colour design. However, it is believed that designers' comprehensive knowledge and awareness of factors affecting colour emotions will enable them to meaningfully control and use of colour in their designs. This could give designers clues for how to control or produce these emotions using colours. Therefore, this study is beneficial for designers to identify their ability and modality of changing, modifying or transforming a person's or society's emotion evoked by colour. Moreover, designers' understanding of target customers emotions and

feelings would facilitate them to select the right colour for their products (Xin, Cheng, Taylor, Sato & Hansuebsai, 2004a).

2. Discussion

Researchers have for long been studying colour in terms of preference and emotions evoked. This is in order to understand effect of colour on consumer or audience. Consumer research studies show that colours are capable of eliciting and evoking different emotions. These emotions are affected by several factors. These are associations with object or process, convention, innateness, culture, preference, religion, colour specification and meaning. Moreover, emotions evoked by a colour could be related to respondent personality, (emotional) experience with the perceived colour, respondent eye contact, predisposition, race, ethnicity, sex and age. In this section, the author discusses these factors based on previous research studies from different cultures.

2.1. Effect of colour attributes/specifications

Testing colours in terms of colour-emotion associations require identifying and selecting these colours employing an international colour model in which colours are represented by three values, i.e., Hue, saturation and brightness.

Guilford (1934) studied the affective value (AV) of colour as a function of hue, tint, and Chroma. These colour attributes were found determinants of AV for women with 67%, 20% and 5% respectively and 16%, 5%, 13% for men AV. However, the three attributes combined 71% of the AV for women and 26% for men (Guilford, 1934).

Lo (1936) studied the AVs of colour combinations. Eighteen colours were used to produce 153 colour combinations which were graded by subjects towards pleasantness. These combinations were found mostly unpleasant. Colour combinations at the two ends of the spectrum were the most unpleasant. This would be due to the big difference in wavelength and darkness between colours at two ends of colour spectrum. The most pleasant binary colour combinations were for blue, green and yellow. Generally, the AV of spectral colours ranging from red to blue increased with decreased wavelength. Colours of close positions on spectrum would induce pleasantness or unpleasantness. Pleasant colours individually do not always give pleasant combination. It was evident in this study that not only individual and combined colours have an impact on AV. However, other factors such as colour pattern, purity, proportion, and background have a role in determining the AV (Lo, 1936).

Guilford and Smith (1959) found that the higher the brightness and saturation, the greater AV was (Guilford & Smith, 1959).

Adams and Osgood (1973) found positive correlations between: brightness and evaluation (strong correlation), darkness and potency. Activity was strongly correlated with colour/no colour and also with brightness (Adams & Osgood, 1973).

Patricia and Mehrabian (1994) investigated emotional reactions (i.e., pleasure, arousal and dominance) to colour attributes (i.e., hue, saturation, and brightness). Pleasure, arousal and dominance emotions were found affected by colour brightness and saturation. However, no evidence was found for relating these emotions to hue. Regression analysis was used to derive equations presenting the correlation between these emotions and colour attributes. Saturation and brightness showed strong and consistent correlations with emotions. Saturation were found affecting these three emotions positively. However, the brightness affected arousal and dominance negatively, on the other hand affected pleasure positively. For pleasure and dominance, brightness was more effective on emotions than saturation. But, this case was reversed for the arousal emotion. Brightness of chromatic and achromatic colours had similar effects on emotion (Valdez & Mehrabian, 1994).

According to Valdez and Mehrabian (1994), previous studies showed that long-wavelength colours (e.g., red and yellow) are more arousing than short-wavelength colours (e.g., blue and green). Valdez and Mehrabian studied the effects of colours on emotions and found that highly saturated colours elicited greater feelings of arousal. Bright colours (e.g., whites, light greys, or lighter colours) were more pleasant, less arousing, and less dominant than less bright colours (e.g., dark greys, blacks, and darker colours). Dark colours were expected to elicit feelings that constitute components of aggression, anger, or hostility (e.g., displeasure, high arousal, or dominance). Bright and low-saturation colours elicited low levels of dominance. The hue 'red-purple' received the lowest score on dominance (Valdez & Mehrabian, 1994).

A study of children's emotional associations with colour conducted by Boyatzis and Varghese (1994) found that 69% of the participants were positively responded (e.g., happiness and excitement) to the colours presented. Most children responded positively to bright colours (pink – red- blue) and become increasingly positive with age. Emotional reactions varied with brightness of colours. There were negative emotions evoked by dark colours (brown- black – grey) (Boyatzis & Varghese, 1994).

Zentner (2001) pointed to the importance of studying the link between saturation (Chroma) and brightness (value), and emotion response (Zentner, 2001).

Kaya and Epps (2004) studied the relationship between colour and emotion of college students. The participants' colour emotion associations were positive for the principle hues with (79.6%), (64.5%) for the intermediate hues and achromatic colours (29.2%). Only 17.8% of the responses to the principle hues' were negative, whereas 68.4% of the responses were negative for the achromatic colours. These findings of the study agreed with that of Saito (1996) in terms of positive and negative emotions regardless different associations (Naz & Epps, 2004).

Ou et al. (2004) carried out a study to clarify the relationship between colour emotions and colour-appearance attributes. A 3D colour emotion space was developed on the basis of the three colour-emotion factors: colour activity, colour weight, and colour heat. Four colour emotion scales, warm–cool, heavy–light, active–passive, and hard–soft, were quantified in terms of colour appearance attributes. The scale warm–cool was connected with hue angle and Chroma, with a reference hue angle of 50°, which was found in this study to be the 'warmest' hue angle. Heavy–light scale was connected only with lightness. Active–passive scale was determined by the colour difference between a test colour and a medium grey with L* of 50. Hard–soft scale was connected to both lightness and chroma (Ou, Luo, Woodcock & Wright, 2004a).

Later, Ou et al. (2004) developed a three-dimensional colour-emotion space for two-colour combinations. This model was based on three axis as the same as that of single colour space. In this study, a colour-combination emotion can be predicted by the arithmetic mean of single-colour emotions (except for like-dislike scale) (Ou, Luo, Woodcock & Wright, 2004b).

In 2004, colour emotional responses were studied by Xin and others. Lightness and Chroma were found more effective on colour emotion than hue. But this was not the case for warm -cool scale of colour emotion. Therefore, they extended their studies looking into the differences in lightness and chroma at 0 hue angle describing the differences between the three regions (Xin et al., 2004a; Xin, Cheng, Taylor, Sato & Hansuebsai, 2004b). Lee and Lee (2006) found that colour emotion was highly affected by its tone.

Stahre, Harleman and Billger (2004) showed that colour size is effective in terms of emotional response. Big size of colour chip was perceived more distinct, stronger, and arouses much stronger emotions than small chips (Stahre, Harleman & Billger, 2004).

Gao and Xin (2006) derived a colour emotion map on CIE LCH model employing three indexes, namely activity, potency and definition. A neutral emotion area was appointed around C (chroma) = 30.5 and L (lightness) = 53.3. Colours distributed on opposite directions of this area possess opposite feelings. Activity, potency and definition were affected by Chroma, lightness and both (C and L)

respectively. The L*C*plane were divided to soft and warm feeling areas correspond to high lightness and Chroma respectively. Hue effect on these indexes was insignificant (compared to other colour attributes) even for warm-cool scale. They indicated that this is consistent with previous studies (Gao & Xin, 2006).

Wang (2008) indicated that there is a systematic relationship exist between colour attributes (Lightness, Chroma and Hue) and emotional response (valence and arousal). A psychophysical experiment was conducted to study that relationship and the results were used to establish prediction equations for emotional reaction of new or other colours. These emotions, i.e., arousal and valence were predicted successfully with 90% and 80% (Ding, Wang, Hu & Wang, 2008).

Lucassen, Gevers and Gijsenij (2011) showed that texture has an important impact on colour response especially for hard-soft scale and works on decreasing weight for masculine–feminine, heavy–light, and warm-cool emotion scales (Lucassen, Gevers & Gijsenij, 2011).

Adler (2017) indicated that previous research studies indicated that ‘Hue’ is described by the dominant wavelength affecting our emotions. Red and blue are two hues of different wavelength – long and short respectively – found of opposite effects. On one hand, red was found increasing perspiration, exciting brain waves and raising the blood pressure, pulse rate, and respiration. On the other hand, blue lowers blood pressure and pulse rate. Brain waves tend to decline and skin response is less (Adler, 2017).

2.2. Effect of timespan

The period of time taken in seeing or watching or perceiving a colour would affect the emotions evoked by this colour. A colour would appear exciting for the first period of time and later become boring. Therefore, the colour emotion association is affected by the length of time a person is exposed to it (Adler, 2017).

2.3. Effect of gender

Gender differences are the variances in person’s behaviour and traits due to sex. Researchers investigated the effect of gender on colour-emotion association.

Sex differences were found of less impact on the AVs of colour combinations than art training (Lo, 1936). In a study conducted by Valdez and Mehrabian (1994), men and women were found highly similar regarding emotion reactions to colour hue, saturation and brightness. However, women exhibited more sensitivity and extreme emotional reaction to different levels of brightness and saturation (Valdez & Mehrabian, 1994).

Boyatzis and Varghese (1994) studied the relationship between children’s sex and colour emotion association. Girls liked bright colours more than dark colours. Boys were more likely than girls to have positive emotional reactions to dark colours than girls who had mostly negative reactions to it (Boyatzis & Varghese, 1994). Hemphill (1996) found that responses to individual colours were very similar for the men and women (Hemphill, 1996).

Regarding observer accuracy of determining colour emotion Ou et al. (2004) found that female observers were significantly higher than male. British and Chinese were similar to each other in emotional response. No gender difference was found between different groups of observers in all the 10 colour-emotion scales (Ou et al., 2004a).

Ou et al. (2004) found good correlations between male and female results for all colour emotions association except masculine-feminine and like– dislike. Female observers tended to associate ‘like’ with the colour pairs that were ‘light’, ‘relaxed’, ‘feminine’ or ‘soft’, whereas this association did not occur for male observers (Ou, Luo, Woodcock & Wright, 2004c)

Pope, Butler & Qualter (2012) investigated colour-emotion associations in children aged 7-8 years in UK. They found no gender differences (for girls and boys respondents in their study) in responding for negative and positive emotions. However, boys and girls responded more appropriate and higher quality for basic emotions than complex ones. No gender differences were found in the expressive verbal vocabulary. Girls were found giving more appropriate and higher quality expressions than boys in emotional understanding. Girls consistently appeared to be able to understand and communicate emotions better than boys. This is pointing to girls' greater emotional understanding and higher emotional maturity. Generally, no interaction effects between gender and emotion responses were found. The researchers referred this to the sample small size of population and recommended larger sample in their future studies. Happy and unhappy emotions were differently linked to girls and boys (Pope, Butler & Qualter, 2012).

Ou et al. (2010) found that female observers prefer colour pairs with high-lightness or low chroma values more than their male counterparts (Ou, Luo, et al., 2012).

2.4. Effect of personality

Cerbus and Nichols (1963) studied the effect of personality on colour response. Various clinical groups—hysterics, anxious and depressed neurotics, and psychotics in general were studied and compared with normals in colour responsiveness. Impulsive and acting-out patients did not respond highly to the colour in stimuli. Changing a stimulus from achromatic to chromatic indicated an alert active subject. Depressed subjects had reduced use of colour indicating the response to the impersonal and not interesting environment. However, no increase use of colour was found for hysterical, anxious individuals, nor for groups of neurotics or schizophrenics. These indecisive and insignificant results were not supporting the application of these findings to interpret personality traits from the use of colour (Cerbus & Nichols, 1963).

Valdez and Mehrabian (1994) reported the difficulty of drawing conclusions related to the effect of personality and psychopathology from the available studies for them because of methodology weakness and invalidity of the measures used in these studies (from their view) (Valdez & Mehrabian, 1994).

2.5. Colour emotion as a function of preference

Terwogt and Hoeksma (1995) indicated that the relationship between colours and emotions (categorised by negative, positive and no) could be explained on the basis of preference.

As colours and emotions are two different domains, therefore they are linked when two of them have the similar position in the preference scale. In other words, highly preferred colours should be tied to highly preferred emotions, whereas non preferred colours should be tied to non-preferred emotions. At the same time, a preferred colour is not likely to be tied to a non-preferred emotion or vice versa.

The higher positions of preference were taken by the positive emotions (including surprise) and the lower positions were taken by the four negative emotions. The preferences for surprise and sadness appeared to be constant across age. Differences in both subjective experiences and environmental reactions contributed to the changing preference for fear and anger at different ages. Besides people opinion would differ due to different experience (Terwogt & Hoeksma, 1995).

Regarding emotion preference, Hemphill (2010) found that positive emotions were highly preferred over negative emotions. 49% of the participants were evoked by positive emotions (i.e., happy, excited, relaxed and positive) 36% of the participants had negative response (anxious, boring, sad and negative). However, 15% of the participants had No emotion (Hemphill, 1996).

Ou et al. (2004) developed three colour preference models for single colours. In the first model, colour preference was determined by the colour emotions clean–dirty, tense–relaxed and heavy–light. Colour preference was found affected most by the emotional feeling ‘clean’. The second model was developed on the basis of the three colour-emotion factors identified in Part I of the study published by the researchers, i.e., colour activity, colour weight, and colour heat. It showed that colour preference of a tested colour could be predicted from its colour appearance attributes. In the third model, colour preference was determined by the colour difference between a test colour and a determined reference colour. Colour emotions were not the only predictor of colour-combination preference. This is because a colour emotion can be determined by specific qualities of individual colours, and colour preference may need to take into account the interrelationship between them (Ou et al., 2004c).

Kaya and Epps (2004) found that 62.2% of the participants expressed positive responses to colours, 34.2% expressed negative responses, and 3.6% expressed no emotion (Naz & Epps, 2004).

Pope et al. (2012) found that generally children linked colour to positive emotions rather than negative emotions. This means that children tended to (prefer) positive emotions more than negative ones. However, colour preferences were significantly different across girls and boys (Pope et al., 2012).

Lee et al. studied how individual’s preference for colours and various is dependent on the emotional state and its interaction with colour’s emotional tone. They found that people tend to prefer colour consistent with their own emotion. In other words, sad people select sad colours and vice versa happy people select happy colours. This consistency between emotions and colours is preferred when an individual finds his emotion reflected his attitude towards the situation and when the coloured object signals person’s committed attitude (Lee, Andrade & Palmer, 2012, 2013).

2.6. Cultural impacts on emotions

Adams and Osgood (1973) studied the effect of cultural difference on colour concepts. 23 different cultures were examined. Subjects from these cultures showed consistent colour emotion association (Adams & Osgood, 1973).

Ou et al. (2004) found that British and Chinese observers of highly correlated emotion scales for all 11 colours tested (Ou et al., 2004b). Later they showed that poor correlation between British and Chinese data was found in tense–relaxed and like–dislike (Ou et al., 2004a).

Ou et al.’s findings (2004) compared to previous research studies show that the four colour emotions, warm–cool, heavy–light, active–passive, and hard–soft, are culture-independent in the following regions, Britain, China, Japan, Thailand, and Hong Kong (Ou et al., 2004a).

A study conducted by Xin, Cheng, Taylor, Sato and Hansuebsai (2004b) investigating differences and similarities of colour emotion in three regions in East Asia namely, Hong Kong, Japan and Thailand. Good correlations were found (more than 0.74) between these three regions. The highest correlations were for light–dark and heavy–light. Distinct–vague correlation was the least one. This might be account for the difference in meaning when translating causing different interpretation (Xin et al., 2004b)

Ou et al. (2010) conducted a cross-cultural comparison of colour emotion for two-colour combinations. Psychophysical experiments were conducted in the UK, Taiwan, France, Germany, Spain, Sweden, Argentina, and Iran to assess colour emotion for two-colour combinations using semantic scales warm/cool, heavy/ light, active/passive, and like/dislike. Consistent responses across different cultures were evident only for warm/cool, heavy/light, and active/passive. The like/dislike scale showed inconsistent results (Ou, Luo, et al., 2012).

2.7. Effect of age

Research studies showed that development of colour perception is related to age. Precision and sensitivity of colour discrimination is kept increasing gradually from birth. Colour discrimination is in its topmost between 20–30 year old and then decreased after that especially after 65 (Adler, 2017). As emotions evoked by colour are affected by its perception, therefore, colour emotions link is expected to be developed with age.

Cimbalo, Beck and Sendziak (1978) studied emotionally toned pictures and colour selection for children and college students including male and female subjects. Researchers argued for the innate association of colour and emotions because young children respond as the older subjects. They pointed to an early learning experience could account for the result. Early learned fear of darkness could become associated with darker colours. In a follow-up study, for both groups, black was associated with night, darkness, and death, whereas yellow was associated with sun, brightness, and warmth (Cimbalo, Beck & Sendziak, 1978).

Boyatzis and Varghese (1994) studied the relationship between children's age and colour emotion association. Children tended to express positive emotions towards bright colours and this tendency increased with age. This was especially true for girls. It was found that colours elicit particular images and emotions which are not believed universal. These depend on children's experiences which could be more idiosyncratic. Children's comments revealed that colour – emotions associations are linked to specific image or event. With increasing age colour-emotion schemes became increasingly different and complex due to gained social experience over time which creates opportunities for more associations. Colour emotion concept development could be related to cognitive development leading to complex conceptualisation of colour emotion association (Boyatzis & Varghese, 1994).

Terwogt and Hoeksma (1995) used three different age groups in their study investigating relationship between colours and emotions. They found that as people are getting older their preferences are developed as well. They indicated that changing preferences with age would affect colour-emotion link. The effect of preference decreased with age. This means that the association strength decreased with age. These results suggest an age trend with respect to the effect of colour and emotion preferences on their combinations (Terwogt & Hoeksma, 1995).

Hemphill (1996) indicated that colour-emotion associations became more complex with increasing age. There were consistent preference for positive (i.e., surprise) and negative (i.e., sadness) emotions across age (Hemphill, 1996).

Zentner (2001) studied colour emotion combination in early childhood. Children in the age of 3-4 year old and adults were employed. Children were asked to match the suitable colour from a group of primary colours with emotional facial expressions namely sadness, happiness and anger. This study found that association of happiness with bright colours (yellow) and sadness with dark ones (blue) is established by the age of 3. These findings were found correlated with adults' assessment. However, colour emotion association were found in research studies developed by the age of 10 to include black as sad and red as angry. This supports the point that children recognition for colour associations with emotions are gradually developed and acquired throughout preschool and elementary school years. Children were successfully able (compared to adults findings) to classify and recognise and relate colours to facial expressions. This would be because children rely on cultural conventions when linking colours to emotions. Another reason would be that children development in this area is affected by the way facial expression are coloured in children's books, by colour-emotion metaphors used in English language, 3-year-old children were found easily able to categorise colour emotions (Zentner, 2001).

Burkitt, Barrett and Davis (2007) agreed with Zentner's interpretation of children's using of colour in accordance with emotion. This was their affect with colours used in pictorial conventions used in

colouring books and other media. In their study, children were able to use colours in representing positive and negative characters and emotions (Burkitt, Barrett & Davis, 2009).

Ou et al. (2010) studied the effect of age on colour emotion and found that for single and light colour pairs and achromatic colours were rated less on emotion scales for old subjects than young observers. These were active, like, and cold scales for single colours, active and cold for light colour pairs (colour combinations), cold, like and harmonious for achromatic colour pairs. These findings challenged other studies findings adapting the principle of human retaining consistent colour perception across life span (Ou, Luo, Sun, Hu & Chen, 2012). Ou et al. 2012 stated that older observers liked colour pairs with high-lightness or high-chroma values more than young observers did (Ou, Luo, et al., 2012)

2.8. Colour context

The context in which a colour is used and presented could have a pivotal role in perceiving colour which in turn affects the colour emotion link. Most studies showed blue as a pleasant colour. On the contrary, blue may elicit unpleasant reactions when used in colouring hair and food because of its inappropriateness to this context/product (Valdez & Mehrabian, 1994).

2.9. Religion

Saito (1996) explained the possible influence of ancient Japanese religion and mythology on the Japanese preference for white. A small number of Saito's subjects in Taipei expressed a negative feeling toward white, indicating an association with the image of death (Saito, 1996).

2.10. Physiological reaction

According to Terwogt and Hoeksma (1995), Gerard (1957) showed that the connection between Colour and emotion is referred to common physiological reaction patterns. The colour red and the emotion of anger both have an energizing effect that calls for action and are therefore linked to each other (Terwogt & Hoeksma, 1995).

2.11. Subjective experience

Schachtel (1943) indicated that subjective experience affects the relationship between colour and emotion.

2.12. Colour convention

Kaya and Epps (2004) reported some colour associations in their study investigating the relationship between colour and emotion for college students. Green colour evoked positive emotions such as relaxation and comfort because it reminded most of the respondents of nature. The colour green-yellow had the lowest number of positive responses because it was associated with vomit and elicited the feelings of sickness and disgust. For the achromatic colours, white attained a large number of positive responses, followed by the colours black and grey. The colour yellow was generally seen to be lively and energetic and elicited positive emotions including happiness and excitement because it was associated with the sun, blooming flowers, and summer time. White was seen to be positive and was associated with the feelings of innocence, peace, and hope because it tended to be related with purity and being simple and clean (Naz & Epps, 2004).

The colour green yellow elicited the highest number (71.4%) of negative emotional responses because it was associated with vomit and elicited the feelings of sickness and disgust (Naz & Epps, 2004).

2.13. Race

Boyatzis and Varghese (1994) indicated that children's culture and race were possible sources of color- emotions association. The participants in their study were white: that would be the reason for children negative emotions of dark colours. Lo showed that racial differences were found of less impact on the AVs of colour combinations than art training (Lo, 1936).

2.14. Educational background

Colour preferences were found affected by art training when subjects from different backgrounds and levels of studying art were employed in a study the AVs of colour combinations (Lo, 1936).

Ou et al. (2012) found that design background liked low-chroma colour pairs or those containing colours of similar hue more than non-design observers (Ou, Luo, et al., 2012).

3. Conclusions

This study addressed aspects that contribute to human emotional response to colour. Most research studies in the field of design has been related to and concerned with identifying colour preferences and emotion elicited by colours. However, a comprehensive and deep understanding of aspects shaping these emotions is very important and beneficial for designers. By reviewing most of the research studies concerned with colour emotion association, it was found that most research studies were concerned with colour attributes, namely hue, brightness and chroma and their impact on colour emotion association. It was found that brightness and chroma had a more important role than that of hue in colour emotion link. It is important to notify that however there have been several factors affecting colour emotion link, most research studies found were related to colour specifications. The timespan of exposing respondent to colour was found to affect the colour emotion link. Gender differences were found to not affect all emotions evoked by colour. As females and males respond were found similar for most emotion scale, no evidence was found for subjects' personality and mental health state impact on colour emotion association. Subjects' preference of an emotion has an impact on preferring the colour evoking that emotion. Consistent results of colour emotion association were evident from several research studies from different cultures. The effect of age from previous research studies pointed to human development in terms of colour perception and, consequently, colour emotion association. Moreover, colour context, religion, physiological reactions, subjective experience, convention, race and educational background were discussed and found to play a role in colour emotion association.

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