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A study on colour harmony and consumer perception of shampoo packages displayed on screen

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Abstract: This study aims to establish a relationship of package colour with colour harmony and consumers' perception of product quality. Specifically, it focuses on the package design of hair shampoo bottle generating observer's positive emotions and expectations. Forty shampoo bottle package stimuli with 10 different colours and 4 different images of packages were presented to 70 participants and their psychological responses for colour harmony, quality, liking and effectiveness were recorded using semantic differential method. Two major findings were identified, the first one being, colour harmony of shampoo bottle packages and liking are highly correlated with each other ($R = 0.94$ and $p = 0.05$) and with quality ($R = 0.86$ and $p = 0.05$ and $R = 0.89$ and $p = 0.05$) respectively. In the second finding, the differences in colour attributes like Chroma, Lightness, and Hue of package colours also affected the observer's responses towards the four semantic scales.

Keywords: package colours; shampoo bottle packaging; consumer perception; colour harmony; liking; effectiveness; chroma.

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Biographical notes: Mohammed Rajik Khan is an Associate Professor and former Head in the department of Industrial Design, National Institute of Technology, Rourkela, India, since 2011. He received his BE in Mechanical Engineering from Madhav Institute of Technology and Science (MITS), Gwalior, India, in 2001; MTech in Mechanical Engineering from National Institute of Technology, Kurukshetra, India in 2006; and PhD in Mechanical Engineering with specialisation in CAD from the Indian Institute of Information Technology, Design and Manufacturing (IIITDM) Jabalpur, MP, India, in 2011. His current research interests include innovative product design, physical ergonomics, rehabilitation and assistive devices, etc.

1 Introduction

Product packaging plays an important part in marketing, as it distinguishes the company's and the competitor's product. It is also a medium through which companies communicate their product with the customers (Mazhar et al., 2015). Consumers also

make their purchase decision based on the product packaging as it creates a perception of product in their mind. Hence, it is very important to creatively design the packaging of a product to create right perception. Characteristics of packaging like packaging quality, colour, images, labels, etc. affect the consumer's buying behaviour (Raheem et al., 2014).

Colour plays an important role in design, triggering emotions in viewers. Designers use it to deliver design information (Wei et al., 2014). In product design, positive emotions increase the value of the product and its likelihood of being purchased (Cho and Lee, 2005). Using harmonic colours is one way to create positive emotions (Burchett, 2002; Wei et al., 2014). Colour perception is also influenced by the context in which they are used. For example, brown colour creates a natural and warm feeling while designing an interior with wooden materials. However, when used for a coat, the same colour creates a feeling of dignity and elegance. Thus, a designer needs to be well versed in colour psychology in order to develop products that are liked by most of the customers (Desmet et al., 2001; Lee et al., 2009).

Judd and Wyszecki (1975) defined colour harmony as the use of at least two complementary colours that create a pleasing effect. The term can be defined as using colours in a way that appeals to customers as well (Granville, 1987). For a long period, experts have tried to determine the combinations of colours which produce pleasing effect. Their research can mostly be divided into two categories; first category depends on the systematic organisation of colours and second category is dependent on their association with each other (Ou and Luo, 2006). In past investigations, Ostwald (1916) has concentrated on systematic selection of colours in a colour order system. Munsell's (1921) research has showed that analogous or complementary colours with respect of hue, lightness or Chroma can deliver harmonious groups. The difference in hue is one of the most reliable impacts found in the colour harmony research. Ostward (1916), Munsell (1921), Moon and Spencer (1944) and Ou and Luo (2006). These investigations have demonstrated that if colours have the same hue, they harmonise. A few speculations and studies regarding colour harmony also determined that colours harmonise when their hues are complementary to each other (Chuang and Ou, 2001; Ostward, 1916; Munsell, 1921; Moon and Spencer, 1944). Equal-Chroma rule has been suggested by many past researchers, like Moon and Spencer (1944), stating that when two colours are equivalent or comparative in Chroma, their colour arrangement looks harmonious. In addition, Ou and Luo (2006) defined a principle that colour harmony is the result of similarity in Chroma and hue among individual colours in a colour pair. Lightness-related standards like complementary-, equal- and high-lightness rules of colour harmony were also recommended in addition to Chroma and hue related principles (Szabo et al., 2010; Ou et al., 2006; Szabo et al., 2010; Palmer and Schloss, 2010). Image of the product and design of the package with harmonious colour pleases the customer. So, it can be deduced that a product creates a pleasing effect if the colours of the package are harmonious too.

In a study on customer expectations, Oliver (1980) and Olson and Dover (1979) have stated that consumer perception of product influence the pre-purchase beliefs of a product or service. Based on a research by Hutchings (2003), purchase decisions and consumer expectations are influenced by the past involvement of customers, promotions, gossip, brand image and competitors' awareness.

The impact of package design on customer's perception by controlling six characteristics of package graphic design (brand, background colour, information, price, shape, and language) have been studied by Deliza et al. (2003). Participants were asked to rate their expectations for every stimulus on refreshing, sweetness, liking, sharpness, freshness, naturalness and pureness. Information and background colour have shown substantial effect on perception.

In a study on orange juice packaging colour and consumers' perception, Wei et al. (2007) has analysed the impact of colour of the package (background colours of a package design) on buyers' purchasing behaviour. Participants were asked to evaluate packages of orange juice with various background colours using six different scales (bipolar), i.e., healthiness (unhealthy–healthy), position in market (economy–luxury), quality (poor–high), flavour strength (weak-strong), freshness (stale–fresh) and refreshingness (not refreshing–refreshing). Situation in the market, quality, and healthiness have disclosed comparable outcomes and can be additionally classified into a more extensive classification of 'product quality'. Products with light or dark colours of package design are considered to be of good quality and with light or mid-level colours are considered as poor quality. Similarly, freshness and refreshingness scales have demonstrated the same type of results and were arranged into a more extensive classification of 'freshness'. An orange juice will be considered fresh if vivacious colours were utilised during package designing. Hence, the relation of freshness to Chroma of package colours can be justified. Deliza et al. (2003) have shown that the colour of a package's background affects customers' expectations.

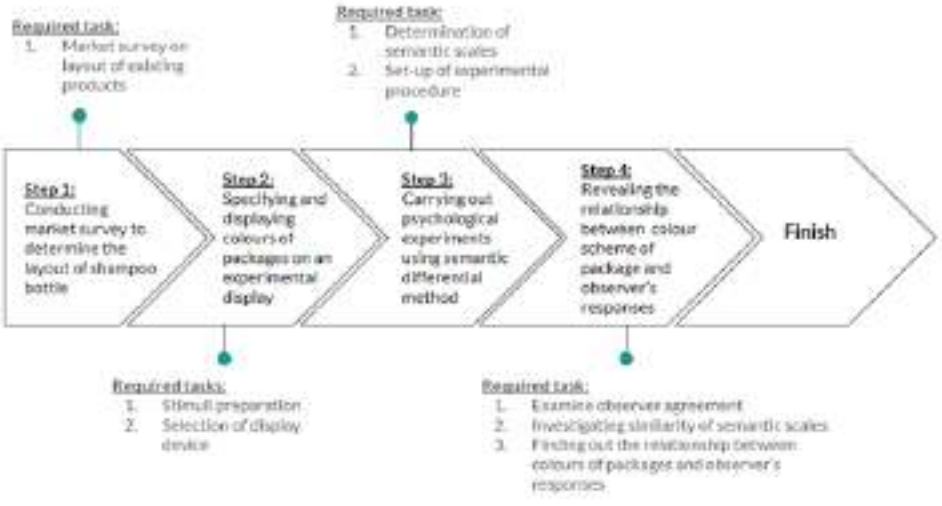
Many studies have examined the effect of packaging colour and design on food products. No researches till date have examined the impact of colour harmony on packaging of shampoo bottle. Hence, the present study investigates the effect of colour on colour harmony and consumer expectations of shampoo bottle package design. Various virtual stimuli were developed to record the observer's responses on colour harmony, quality, liking and effectiveness of package designs. Results of this study could be used as a guideline in branding and packaging design of hair shampoo or similar consumer products.

2 Materials and methodology

The basic structure of the study is to initially ask the participants to rate the images of the shampoo bottle models, which are digitally displayed on the colour calibrated laptop screen (using built-in calibration tools), on the basis of colour harmony, quality, liking and effectiveness. Finally, a relationship between contextualised colours and participants responses is established. Figure 1 shows the series of steps followed in the current study. In the first step, a market survey was conducted on the existing shampoo bottles to determine a typical layout of the shampoo bottle package stimuli. Second step was to specify the different colours used for the stimuli. In order to measure the colour and to determine if the chosen colours for packaging cover an extensive range of colour space, CIELAB uniform colour space was utilised. In third step, a psychophysical experiment was carried out using semantic differential method and the responses from the participants, while assessing different stimuli using semantic scales, were collected.

Responses were evaluated and a relationship between colours and the observer's responses was developed in the last step.

Figure 1 Flow map of methodology used in this study (see online version for colours)



2.1 Market survey

The objective was to determine a basic layout for designing the stimuli by surveying graphic designs of the existing shampoo bottles. Forty shampoo bottle packages randomly selected from the Indian market were surveyed (Appendix 1). The significant features of the 40 packages considered were the shape of the package, main image, package colours, product name and brand name (Wei et al., 2014). These features were arranged into four categories, such as packages with brand and product name

a above the main image

b separated by the main image

c below the main image

d overlapping the main image

Nineteen of the forty packages were found to follow the first category of layout, followed by seven, six, and five for the second, third, and fourth categories. Hence, the first category of design layout was utilised in developing the stimuli.

2.2 Preparation of stimuli

Stimuli were created using the image of an existing shampoo bottle in Adobe Photoshop CC 2015 which was finalised from the market survey. Initially, logos, images and information picture colours were removed from the selected shampoo bottle and were replaced with new designs as shown in Figure 2. Five such images were placed side by

side to create the stimuli. The image created by modifying the existing shampoo product design was considered as the 'base' image and further, by altering the colour and image of 'base' image, rest stimuli were created.

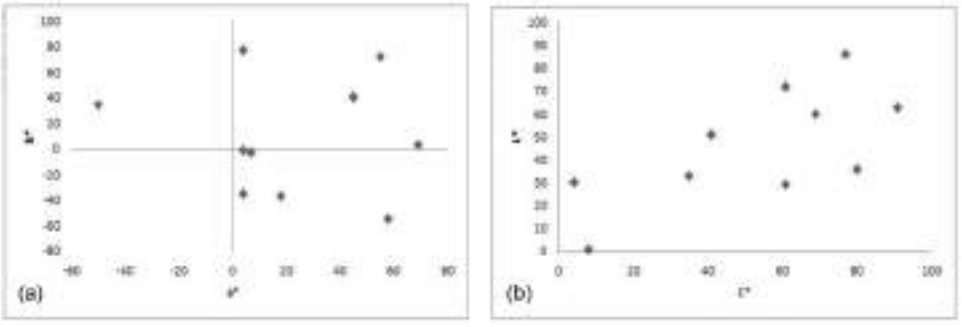
Figure 2 Procedure for preparing the stimuli

A total of 40 stimuli were developed using four images and 10 colours of package. The four images used are shown in Figure 3 which includes hibiscus (P1), soap nuts (P2), almonds (P3) and eggs (P4). These images were selected based on the ingredients preferences given by the participants from the selected 40 shampoo bottles. Rest of the package appearances such as shape, logo, information, etc. remains unchanged for the stimuli.

Figure 3 Package images utilised in the study (P1) hibiscus, (P2) soap nuts, (P3) almonds and (P4) eggs

CIELAB Colour space was utilised to render colour stimuli defined by the International Commission on Illumination (abbreviated CIE). It is an unvarying space of colour consisting of 3 scales which are orthogonal to each other. The three scales are L*, a* and b* where, L* represents the lightness axis and a* and b* represents two opposite pairs of colours i.e., a* for redness-greenness and b* for yellowness-blueness. Two additional attributes of colour are Chroma and hue, measured by transforming a* and b* axes into C* and h (polar coordinates). Ten colours are selected by following the guidelines given by Ou and Luo (2006) on how to render package colours in his study. By averaging the L*, a* and b* of all the pixels in the background areas of the packages, the specifications of the package colours were calculated. Adequate space has been covered by the 10 package colours in CIELAB colour space (Figure 4). As pale colours in the research conducted by Ou and Luo (2006) did not justify the use in this study so, different package colours were used. When these pale colours were used, texture details of the packages vanished.

Figure 4 10 package colours in CIELAB space: (a) a* – b* plane and (b) L* – C* plane



2.3 Population study

A total of 70 observers, 35 male and 35 female have agreed to participate in the survey. All the observers were aged between 20–25 years (average = 22 years). They were mostly undergraduate and post graduate design students of National Institute of Technology Rourkela, India. These students belong to various geographical regions of India. Prior consent has been taken for the study and all the observers have normal colour vision so they are all well suited for this experiment.

2.4 Questionnaire study

In questionnaire study, participants were asked to score the shampoo bottle packages with different colour schemes for four semantic scale parameters, colour harmony (disharmonious to harmonious), quality (poor to high), liking (dislike to like) and effectiveness (most to least effective). The scales of colour harmony, quality, liking and effectiveness quantify the observer's responses for the colour scheme, quality, liking and effectiveness of the packages perceived by them respectively. The four semantic parameters were scaled from 1 to 10 integers where 1 to 5 signifies the degree of agreement in the left most end, with 1 and 5 being strongly and weakly agree respectively. Similarly, integers from 6 to 10 signifies the degree of agreement in the right most end, with 6 and 10 being weakly and strongly agree respectively. For example, taking the parameter of 'Quality', the ten integers from 1 to 10 represent 'very poor', 'quite poor', 'poor', 'a little poor', 'slightly poor', 'slightly good', 'a little good', 'good', 'quite good', and 'very good', respectively.

2.5 Experimental procedure

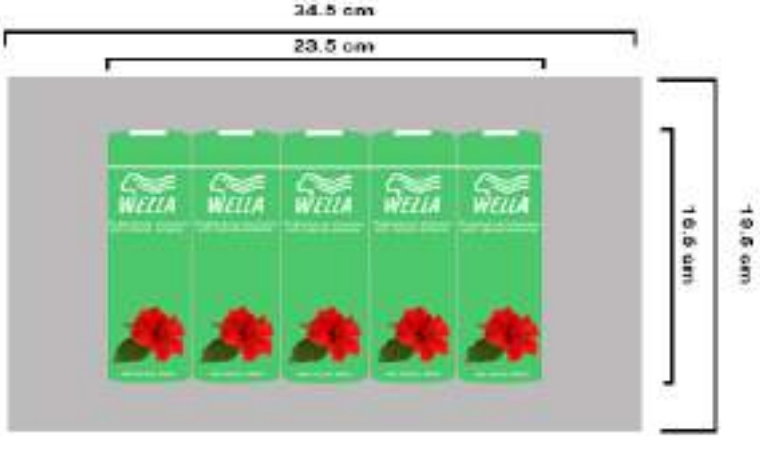
Experimentation was performed inside a closed room where the only source of light was from laptop screen (15.6-inch LED-HD display) where the stimuli were been shown. Observers distance to the screen was kept 50 cm approximately. In this pictorial observation, the aspect ratios of the pictures have not been altered. It's the visual perception of the individual to observe the graphics in each packaging design where shape of the package, main image, package colours, product name and brand name has to be observed. The individual has the freedom to zoom in/out to evaluate the graphics. However, weight, centre of mass, grasp, etc. have not been considered in this survey. The

participants were briefed with clear instructions of the experiment before stating the survey. Adaption time of three minutes was given to observers to get adapted to the screen's luminance level. Similar approaches have also been preferred in studies related to the aesthetic responses to the colour combinations in the past (Schloss and Palmer, 2011).

During experimentation, the participants/observers were asked to rate the four semantic parameters, colour harmony, quality, liking and effectiveness of 40 stimuli on a scale of 1 to 10. Evaluation of the 16 stimuli **was** repeated for each semantic parameter. These 16 stimuli were packages of 4 images using 4 package colours. Four package colours covering a wide range of CIELAB space were selected for the repeated measurement, which are green (L* = 72, a* = –50, b* = 35), orange (L* = 63, a* = 55, b* = 72), purple (L* = 36, a* = 58, b* = 55) and yellow (L* = 86, a* = 4, b* = 77).

In the experiment, the stimuli were shown in random order on the laptop screen so that the observers were not used to the order of the colours which indirectly **affect** the scoring. Each stimuli display was separated by a 500-ms inter-trial interval and continued until observers made a response. They were allowed to take a break after each 30 trials. Figure 5 shows the style of stimuli presented on the laptop screen during the experiment. The viewing distance was about 50 cm (approx.) from the screen. The background of the display was kept neutral grey.

Figure 5 User interface utilised in the experimentation



3 Results

3.1 Intra- and inter-observers agreement

To examine the consistency of data collected from the survey, data was analysed by inter- and intra-observer agreements. Whether the observer's first and second response of the repeated stimuli for the same colour agrees with each other is evaluated by intra-observer agreement and inter-observer agreement evaluates whether the observer's response agrees with the mean of the responses of total observers (i.e., majority response) for the same semantic parameter. Inter- and intra-observers responses were levelled with the help of RMS values measured with equation (1). RMS is a widely used parameter to analyse

rating reliability in the area of colour science and concludes the similarity between the two sets of data (Ou et al., 2004, 2006). Minimum value of RMS represents how close the responses are whereas the maximum RMS value represents how different the responses (e.g., 1: 'poor quality' and 10: 'high quality') are to the same stimulus. Greater values of RMS demonstrate weaker inter- or intra-observer agreements.

$$RMS = \sqrt{\sum_{i=1}^{n} (y_i - x_i)^2 \Big/ n} \tag{1}$$

In case of intra-observer agreement, x_i and y_i indicates the response rating of a single observer's first opinion and second opinion for the *i*th stimuli. Similarly, for inter-observer agreements, x_i and y_i indicates, single observer's response and mean response rating of the entire observers for *i*th stimuli. Here, *n* represents the number of repeated stimuli (16 for present study) and total number of stimuli (40 for present study) for intra- and inter-observer's agreement respectively.

Outcomes of the intra- and inter-observer's agreement on the basis of RMS can be seen in Table 1. For intra-observer agreement, mean of the RMS's was lower than 2.5 units with 1.60 and 1.41 units for male and female observers respectively. For both the genders, difference between repeated assessments was less than 2 units on a measuring scale of 10 units which suggested a reliable intra-observer agreement.

Table 1 RMS values of intra- and inter-observer's responses

Intra-observer agreement				*Inter-observer agreement*			
Male		*Female*		*Male*		*Female*	
Observer no.	*RMS*	*Observer no.*	*RMS*	*Observer no.*	*RMS*	*Observer no.*	*RMS*
1	1.73	1	2.07	1	1.60	1	1.71
2	2.73	2	1.79	2	2.36	2	2.15
3	1.48	3	1.95	3	2.24	3	1.84
4	3.05	4	1.42	4	2.25	4	1.61
5	1.28	5	1.68	5	2.33	5	1.64
6	2.20	6	1.82	6	1.97	6	2.45
7	2.15	7	1.65	7	1.93	7	2.00
8	1.57	8	1.84	8	1.12	8	2.09
9	2.22	9	1.29	9	1.94	9	2.02
10	1.32	10	1.80	10	2.17	10	2.20
11	2.25	11	2.20	11	1.84	11	2.28
12	1.55	12	2.09	12	1.76	12	2.33
13	1.47	13	1.97	13	1.16	13	2.03
14	2.39	14	1.66	14	1.96	14	2.09
15	1.73	15	2.05	15	1.85	15	1.93

Table 1 RMS values of Intra- and Inter-observer's responses (continued)

Intra-observer agreement				*Inter-observer agreement*			
Male		*Female*		*Male*		*Female*	
Observer no.	*RMS*	*Observer no.*	*RMS*	*Observer no.*	*RMS*	*Observer no.*	*RMS*
16	2.10	16	1.64	16	1.83	16	1.97
17	2.06	17	1.94	17	1.93	17	2.22
18	2.48	18	1.88	18	2.18	18	1.91
19	1.49	19	0.86	19	1.33	19	1.81
20	1.23	20	1.05	20	1.35	20	1.86
21	1.69	21	1.46	21	1.68	21	1.92
22	1.58	22	1.01	22	1.71	22	1.83
23	0.75	23	0.73	23	0.65	23	0.79
24	1.16	24	1.12	24	2.01	24	1.73
25	2.13	25	0.92	25	2.02	25	2.00
26	1.07	26	0.89	26	2.35	26	2.21
27	0.78	27	0.87	27	1.92	27	1.93
28	0.74	28	0.87	28	1.95	28	2.17
29	1.82	29	0.85	29	1.91	29	1.95
30	1.34	30	0.91	30	2.04	30	2.03
31	0.85	31	0.87	31	2.03	31	2.22
32	0.86	32	0.89	32	2.00	32	2.15
33	0.93	33	0.91	33	2.07	33	2.03
34	0.92	34	0.94	34	2.08	34	2.06
35	0.98	35	0.92	35	2.23	35	2.19
Mean	*1.60*	*Mean*	*1.41*	*Mean*	*1.88*	*Mean*	*1.98*
Std.	*0.61*	*Std.*	*0.48*	*Std.*	*0.37*	*Std.*	*0.28*

For inter-observer's agreement, mean of RMS was less than 2.5 units with 1.88 and 1.98 for male and female observers respectively. Differences among the responses of individual's and majority for both the genders were below 2 units on a scale of 10 units, indicating high inter-observer agreement.

3.2 Genders differences

Gender differences for all the four semantic parameters (colour harmony, quality, liking and effectiveness) at each image (P1, P2, P3 and P4) were evaluated through root mean square (RMS) values and the results are shown in Table 2. RMS values of gender differences for colour harmony at P1 and P2 are greater than 1.5, whereas for other cases RMS value was found to be less than 1.5 units. This shows that the results obtained can be effectively used for further analysis.

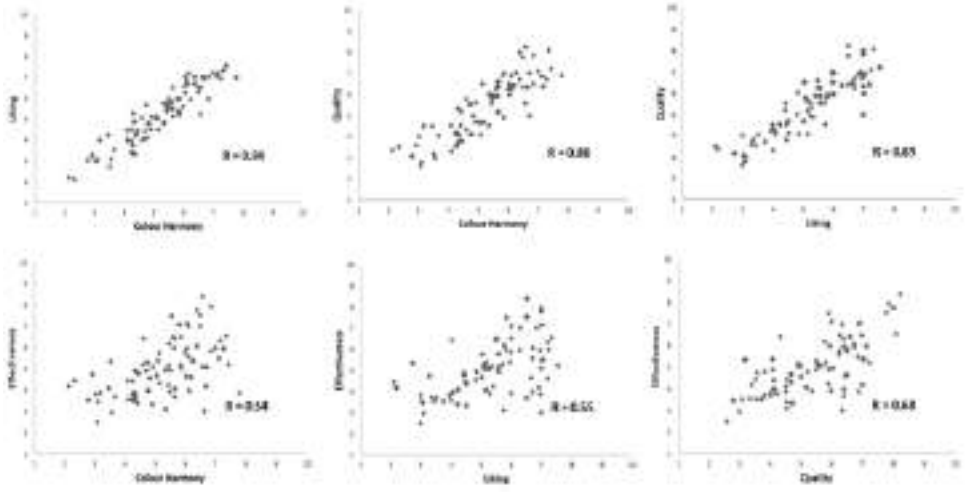
Table 2 Gender difference results

RMS	*Colour Harmony*	*Quality*	*Liking*	*Effectiveness*
P1	1.45	1.28	1.22	1.29
P2	1.63	1.34	1.45	1.48
P3	1.49	0.96	1.39	1.35
P4	1.63	1.3	1.4	1.21

3.3 Relationship between parameters

Figure 6 illustrates the association between semantic parameters and shows the similarity in responses for the colour design of shampoo bottle packages. Scattered plots (Figure 6) are used to provide a representation of Pearson correlations (R) by considering the probability $p = 0.05$ to determine the correlations between semantic parameter scales. Quality and liking have shown high correlation with scale of colour harmony ($R = 0.86$ and $R = 0.94$ at $p = 0.05$, respectively). Additionally, quality and liking have been found to be highly correlated. ($R = 0.89$, $p = 0.05$). It has also been shown that effectiveness weakly correlates with three other semantic parameters, colour harmony, quality, and liking, with $R = 0.54$, 0.68 and 0.55 respectively at $p = 0.05$.

Figure 6 Scatter plots of relationships between each pair of four scales



3.4 Effect of colour on observer's responses

A package's images and colours influence the semantic parameter scales **of** colour harmony, quality, effectiveness and liking. To associate colours of package images with colours of package, the following indicators were considered: differences or/and sums of lightness (L*diff and L*sum), hue angle (h*) and chroma (C*diff and C*sum) along with chromatic difference (C*) among colours of shampoo package images and colours of package. Chromatic difference (C*) is comprised of Chroma (C*diff) and hue differences (h*diff) (Ou and Luo, 2006).

Table 3 provides the characteristics of the colours of four shampoo package images. On the basis of results of a study by Wei et al. (2009), colours were determined for each package image. During the experiment, observers were told to characterise major parts of shampoo package images which trigger them most while scoring. The colours of these mentioned parts were taken as the colours of the shampoo package images.

Table 3 Representative colours of four shampoo package images

Image	*Major part*	*L**	*a**	*b**	*C**	*h*
P1	Flower petals	41	63	54	82.98	4
P2	Seeds	62	4	–10	10.77	248
P3	Skin	66	–22	53	57.38	75
P4	Yolk	58	42	53	67.62	21

3.5 Effect of lightness

Studies conducted by Ou and Luo, (2006) and Szabo et al. (2010) states that colour harmony of a package colour increases due to higher lightness value (L*sum) of component colours. In other past researches, it has also been seen that smaller lightness difference (L*diff) leads to colour disharmony. But in the current research for shampoo package design, such relationships were not discovered. The values of the correlation coefficient (*R*) for four semantic scales across three lightness related attributes have been shown in Table 4. It was found that lightness sum (L*sum) and the lightness of package colours (L*bg) showed negative correlations with all semantic scales, suggesting that the increase in lightness decreased colour harmony, liking, quality, and effectiveness of shampoo packages. Moreover, effectiveness has the most negative effect on lightness since it has a correlation coefficient (R) of about 0.57. This analysis suggests that packages with light colours are effective for shampoo bottles. Figure 7(a) depicts the association between effectiveness and lightness of package colours (L*bg).

Table 4 Correlation coefficient (R) of the 04 semantic scale parameters against L*bg, L*sum, L*diff, C*bg, C*sum, C*diff and C*

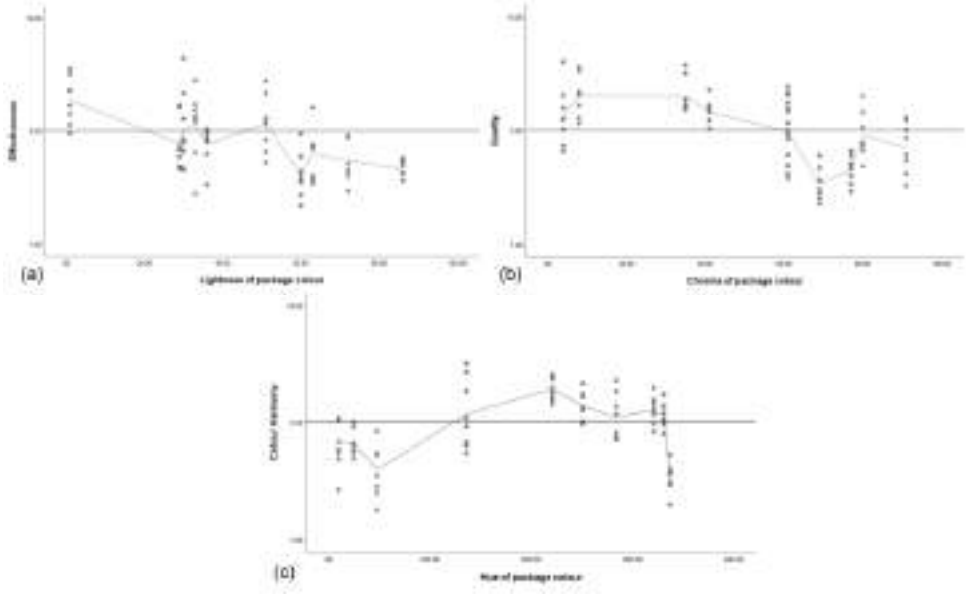
R	*L*bg*	*L*sum*	*L*diff*	*C*bg*	*C*sum*	*C*diff*	*C**
Colour harmony	–0.45	–0.40	0.14	–0.48	0.30	0.19	0.09
Quality	–0.48	–0.42	0.30	–0.58	–0.39	0.18	0.06
Liking	–0.46	–0.41	0.21	–0.53	0.38	0.23	0.09
Effectiveness	–0.57	–0.48	0.39	–0.53	–0.33	0.18	0.13

3.6 Effect of chroma

Correlation coefficient (R) values for the 4 semantic scales across four attributes of chroma (chroma of package colours (C*bg), chroma sum and difference (C*sum and C*diff) and chromatic difference (C*)) are given in Table 4. The Chroma of package

colours shows a negative correlation, indicating that increasing the Chroma decreases its impact on the four semantic scales of shampoo package design. Additionally, the Chroma sum (C*sum) and Chroma of package colours (C*bg) show moderate correlation with scales (–0.58*R*0.30) whereas the Chroma difference (C*diff) and Chromatic difference (C*) show weak correlation (0.23 > R > 0.06). It can be inferred from the results that light Chroma colours are more effective than high Chroma colours. Figure 7(b) shows the graph between Chroma of package colour (C*bg) and quality.

Figure 7 Scatter plot between; (a) lightness of package colours (L*bg) and effectiveness; (b) chroma of package colour(C*bg) and quality and (c) hue of package colour and colour harmony



3.7 Effect of hue

Hue angle is an angular measurement unlike the linear measurements of Chroma and lightness. Hence, scatter plots instead of correlation coefficients (R) were used for assessing the relationship between semantic scale and hue angle. Figure 7(c) illustrates the scatter plot between the hue of package colour and colour harmony. The graph shows that colours with hue angles 0° to 50° are not harmonious. The impact of hue was also similar on the other measures of quality, liking, and effectiveness.

4 Discussion

Study results show that shampoo bottle's packaging with harmonious colours will be liked and will be of good quality. It has been revealed that the colour harmony of shampoo bottle packages is strongly linked to the consumers' expectations of quality and liking, as opposed to the product's effectiveness.

Colour attributes such as Chroma, lightness, and hues of package colours can also have an impact on a viewer's perception of the package's colour harmony. When the lightness of the package image and package colours increases, colour harmony decreases. By this it can be proposed that the dark package colours are more harmonious. Package colours with hue of redness-yellowness have negative effect on the four semantic scale parameters. Chroma also has similar effect on the scales of lightness. High Chroma colours have a negative impact on the viewer's impression of the product.

The current study suggests that shampoo package colours that do not fall under the hue of redness-yellowness or dark package colours give a harmonic impression. This forms a positive psychological connection between the shampoo bottle package design and the consumers. It is necessary to recognise the fact that colour harmony can differ with the context and is not a fixed notion. Evaluating colour harmony under various contexts can give an enhanced understanding of the colour harmony.

The present study was conducted within the specified limits. No pretesting of stimuli images to avoid biases was considered. No physical properties of structures and labels of chosen shampoo bottle packages (stimuli) can be assessed through this methodology. However, these are essential for a comprehensive understanding of a packaging system.

5 Conclusion

Various packaging elements make a strong impact on consumer's buying behaviour especially colour preferences and display information. The relationship of package colour with colour harmony and consumers' perceptions on shampoo package designs has been evaluated in the present study through semantic differential method. It was discovered that harmonious colours used in the shampoo package design, positively affects the liking and quality of the product. However, lightness of package colours is negatively correlated with the four semantic scales indicating that with the increase in its value, decreases the observer's perception towards colour harmony, quality, liking and effectiveness of the shampoo package design. Sum of the lightness of package colour and package image colour affects the scales negatively signifying that the lightness of both package colours and package image colours should be low. Also, it is suggested that customer preferences towards quality product are likely to happen towards harmonious package design. Increase in the Chroma of package colours decreases the observers' liking towards shampoo package design. It was also found that shampoo package colours with hue angle values 0° to 50° have negative impact on the scales. This research successfully studies the effect of colour on consumers' expectations of the shampoo bottle package design. However, colour harmony principles may differ depending on the context of use. Colour preferences will differ for items like luxury chocolates or any seasonal items. Hence, similar design methodology can further be extended to other consumer goods packaging to understand customer's preferences on colour psychology. Future work should be conducted to determine the influence of colour harmony on e-commerce purchase decisions.

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Disclosure statement

The author declares that no conflict of interest exists with anyone pertaining to this study.

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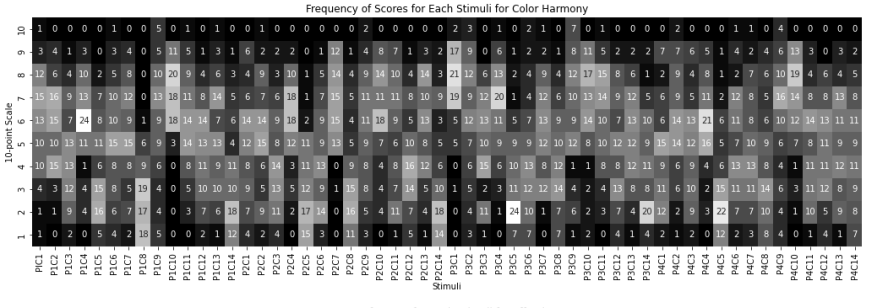
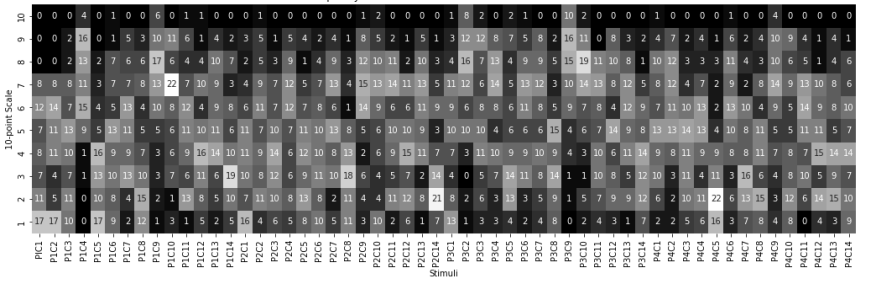
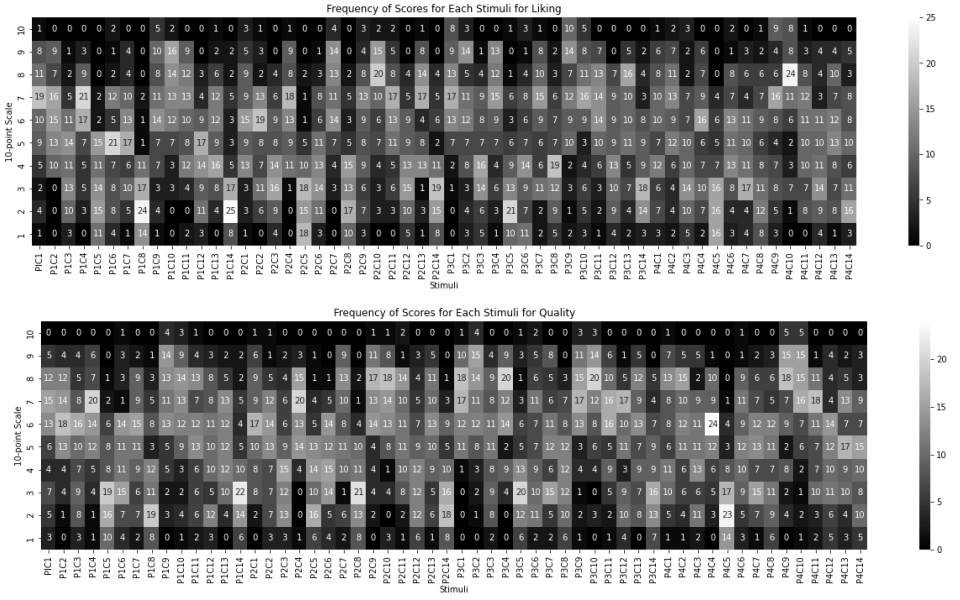
Appendix

Appendix A: 40 shampoo packages used in the market survey

Appendix B: Heatmaps showing visual representation of 10 pt. raw data collected for all the four questions



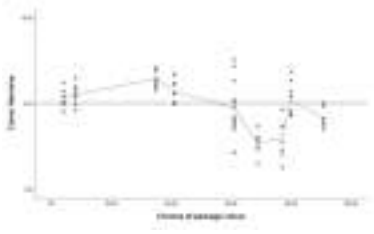
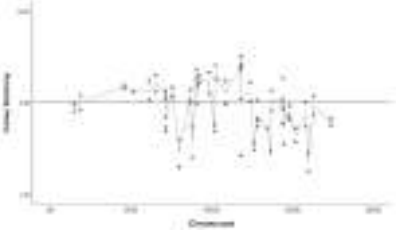
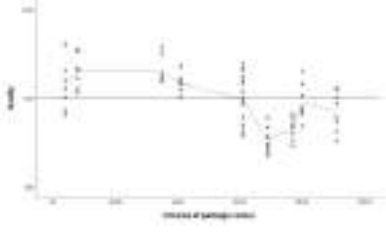
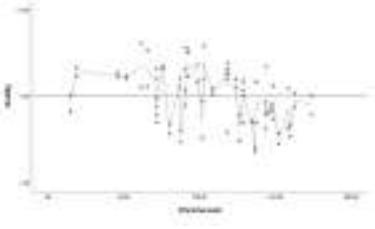
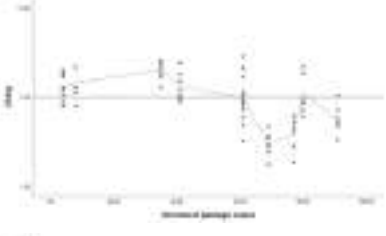
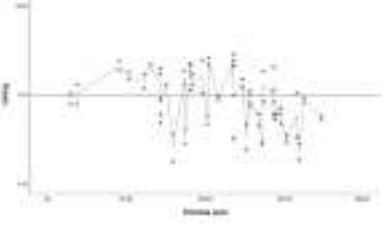
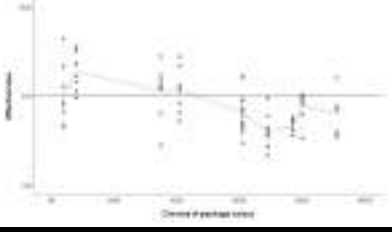
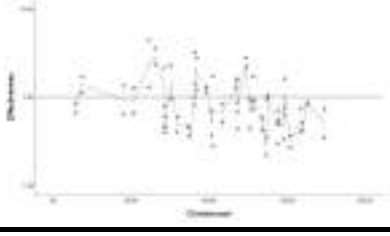


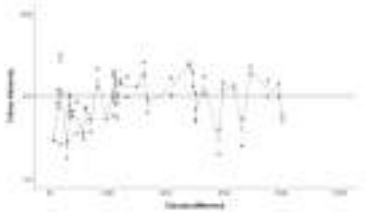
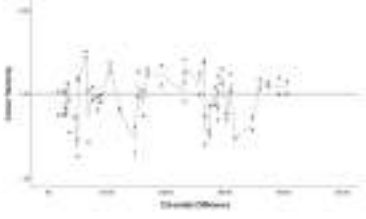
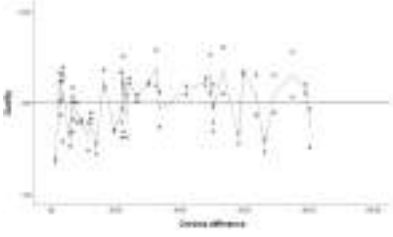
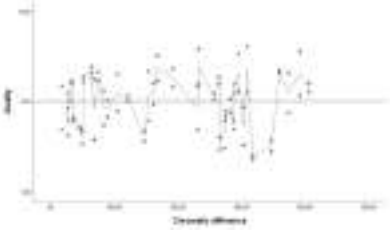
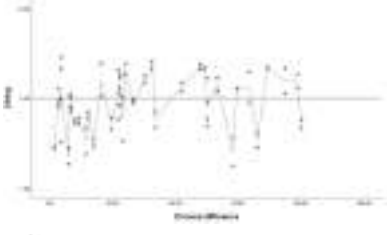
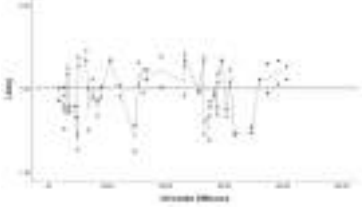
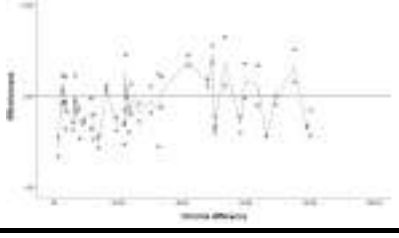
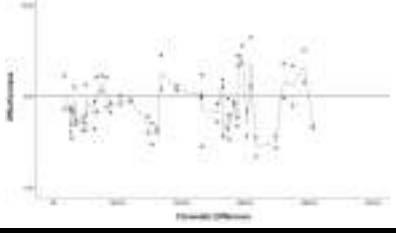


Appendix C: Graphs representing the relationship between attributes of lightness and four semantic scales

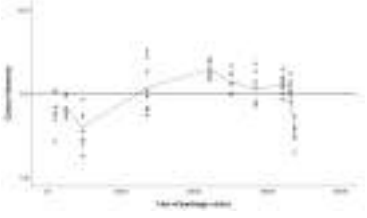
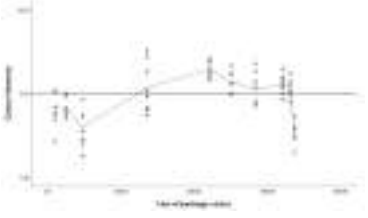
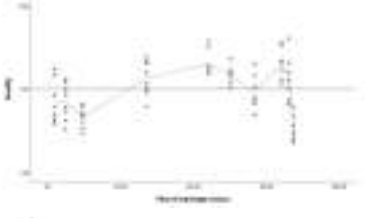
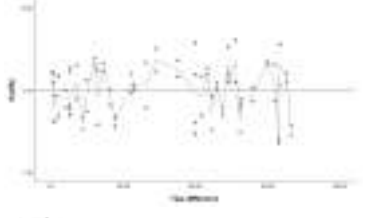
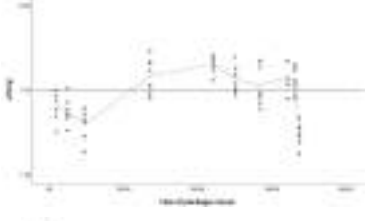
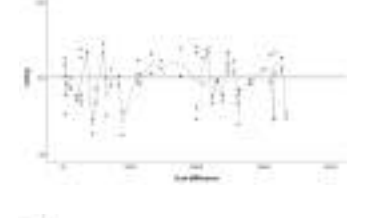
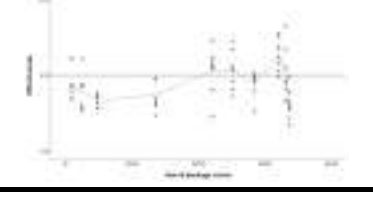
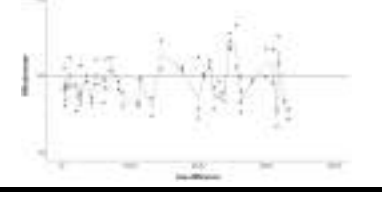
Scale	*L*bg*	*L*sum*	*L*diff*
Colour harmony			
Quality			
Liking			
Effectiveness			

Appendix D: Graphs representing relationship between attributes of chroma and four scales

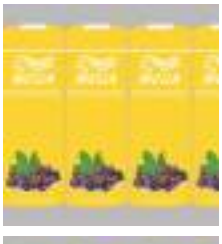
Scale	*C*bg*	*C*sum*
Colour harmony		
Quality		
Liking		
Effectiveness		

Scale	*C*diff*	*C**
Colour harmony		
Quality		
Liking		
Effectiveness		

Appendix E: Graphs representing the relationship between attributes of hue and four scales

Scale	*h*bg*	*h**
Colour harmony		
Quality		
Liking		
Effectiveness		

Appendix F: The most and the least harmonious and effective colour design of shampoo bottle packages

	Most harmonious	*Least harmonious*	*Most effective*	*Least effective*
P1				
P2				
P3				
P4