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The role of individual colour preferences in consumer purchase decisions

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Abstract: The purpose of this study is to test whether consumers' personal colour pre- ferences (in an abstract sense rather than for a particular product) affect their intended product purchase decisions if they are given various colour choices. This work employs two experiments with visual components to investigate which colour a participant would choose if asked to select a product to purchase when there is a range of colours available. Two experiments were also designed to elicit a response about which colour each participant prefers (in an abstract sense). The study finds that personal colour preferences affect intended product-colour purchase decisions but that the extent of this varies from one product category to the next. Further analysis reveals that personal colour preferences are secondary to factors such as colour functionality and colour performance. This work presents new experimental data about the role of colour in product and product packaging on intended consumer purchase decisions. A conceptual framework, supported by the experimental findings, are understanding the relationship between individual colour preferences and product-choice colours, and more functional aspects of colour itself (such as the effect of colour on product's performance or functionality).

Keywords: colour preference; design; packaging; purchase decisions

INTRODUCTION

Consumer decision making can be characterised as a consumer's approach to making a choice. [1] The visual elements of a product, or even its packaging, potentially affect consumer purchase decisions as it provides an attractive method to convey messages about product attributes at the point of sale. These visual elements influence consumers' choice of product (or choice within a product category) and colours are frequently a major component. [2] Indeed, colour is one of the most important elements of visual merchandising and can influence consumer behaviour and consumer purchase decisions. [3,4] Colour can affect consumers' quality perceptions; [5] consumers were found to perceive darker products to be more durable and lighter products to be more convenient. It was suggested that the darker products are perceived to be more durable because consumers infer that darker products are heavier than lighter products. [6] Colour can also provide a central aspect of a brand's visual identity and increase brand recognition. [7-10] It has been argued that colour connects a product to consumers more quickly than any other identifying features. The last few decades have seen an increasingly sophisticated use of colour by marketing and brand experts; [11] for example, brands such as Apple, Dell and GE now frequently display a wide array of colour choices for laptops, mobile phones and even toasters and refrigerators when not long ago these products were grey, black and beige. Yet despite the pivotal role of colour in consumers' daily live,

relatively little marketing research has been carried out in this area.[11] Many practitioners confess to a lack of knowledge upon which to base their colour decisions.[12,13] A major review in 2013, however, was carried out that aimed to re-establish the importance of colour research in marketing and consumer behaviour to fuel further investigation, and the development of new insights about colour from the consumers' perspective.[11] The work in this study is, in part, a response to this challenge.

One of the most important properties of colour is the meaning that colour imparts. Although the internet abounds with information about what different colours mean, most of this information is naive and too simplistic. Aesthetic theorists provide two types of meanings: embodied and referential, such as stimulate and shape consumer preferences. [11] A number of studies have explored the extent to which colour meanings are context specific. [14] Although colour meaning is an important attribute in branding and packaging[15 – 18] consumer personal colour preferences may also be important but their role in purchase decisions is less clear. Numerous studies have explored the relationship between colour and product preference. For example, in one study, colour preferences were explored for a rice cooker in Japan and it was found that very few colours were preferred for this product (white and pink) with a number of other colours being actually disliked by consumers.[19] Meanwhile, a study conducted by Pantone found that the most popular colours for clothing were blue, red and black [20] with black being particularly popular for formal and evening wear. The role of packaging colour for bottled water has been explored and it has been found that consumers have a greater preference for neutral colours as opposed to cool or warm colours. [21] Some studies have considered whether differences in colour preferences between different cultural groups could be used to affect purchase preferences. For example, it has been shown that colour is very important when buying certain product categories for young adult Hispanics, Caucasians and African- Americans in USA with different cultural groups having different preferences.[22] However, very little work has been carried out to explore whether consumers' colour preferences in a general sense (that is, whether a person generally prefers one colour or the other) might affect their purchase-decisions for specific products and product categories.

Colour preference *per se* has been studied by many researchers[23] that although there are some general trends, for instance, people tend to prefer cool colours such as blue and to dislike warm colours such as yellow and orange, and individual colour preferences vary from person to person. [24, 25] There are also some studies that show gender, [26] culture [27] and context [28] may affect colour preferences. Recently a theory has been proposed for why individuals may vary in their colour preferences;[29] this ecovalence theory of human colour preference may not only explain individual colour preferences but suggests that colour preferences might be impermanent (varying over time and with the context).

This study is about whether consumers' personal colour preferences affect their intended purchase decision for various products. An earlier study suggested that for some products consumers are more likely to indicate that they will purchase the product if its colour is similar to their favourite colour. [30] In that study, which focussed on personal cleansing products, it was found, that colour preferences affected intended purchase decisions for a toothbrush but not for a hand soap. No reason was provided for why colour preferences are important for some products but not for others. This study not only aims to build on this work but to also test a conceptual framework (this framework is described in the next section) that can explain why colour preferences seem to matter for some product categories but not for others.

FRAMEWORK FOR COLOUR PREFERENCE AND CONSUMER DECISIONS

Our hypothesis is that the role of colour preference in intended consumer purchase decisions is secondary to other factors but nevertheless can be a powerful driver in some circumstances. That is, consumers may be strongly influenced by their individual colour preferences but only in the absence of other primary factors (Fig. 1).

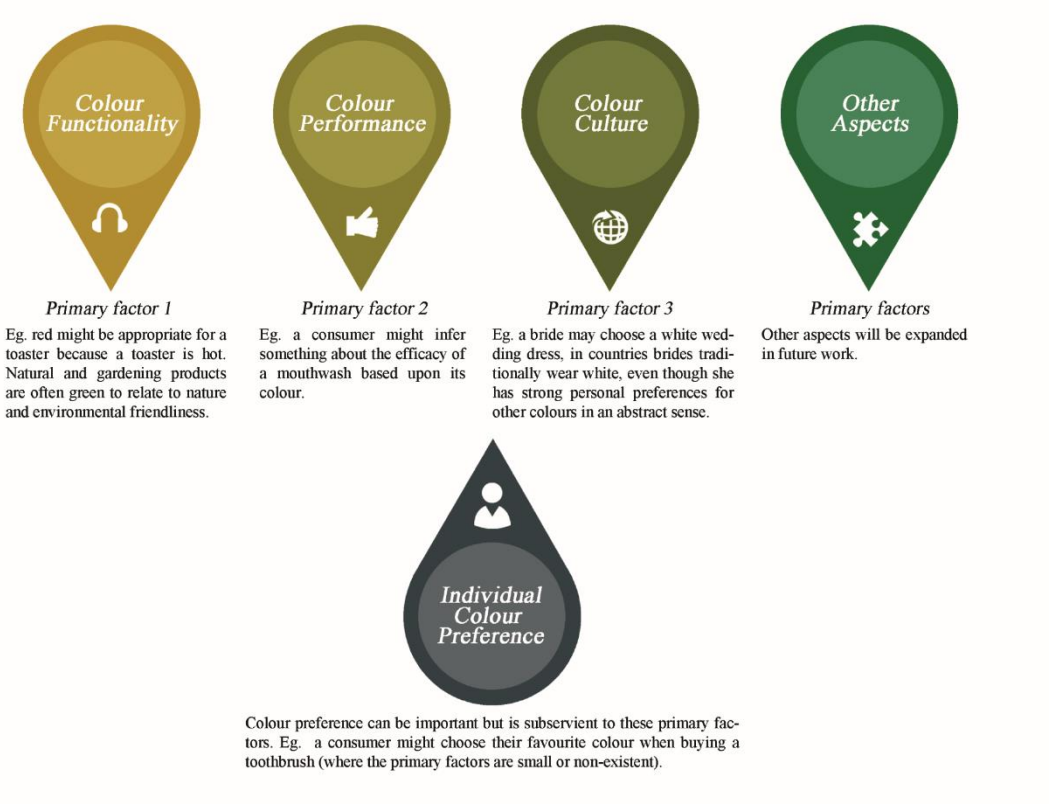


Fig. 1 about here

Fig. 1. Schematic diagram to show the framework for this study: Individual colour preferences affect consumer colour-purchase decisions in the absence of primary colour factors such as colour functionality, colour performance and colour culture. Other primary factors could include, for example, whether a colour fits with an existing colour scheme in the home. Colour preference is only important in the absence of any of these primary colour factors.

In the framework illustrated in Fig. 1, primary factors include *colour functionality*, *colour performance*, and *colour culture*. Colour functionality relates to whether a colour is appropriate for the function of the product. For example, red might be appropriate for a toaster because a toaster is hot. Natural and gardening products are often green to relate to nature and environmental friendliness[31] and televisions with black or silver are suggestive of technology. [32] However, for colour functionality the colour does not usually actually make any difference to the performance of the product itself but rather is simply functionally appropriate. Colour performance, on the other hand, is where the consumer might infer that a product works better when it is one colour rather than another. An example would be that a consumer might infer something about the efficacy of a mouthwash based upon its colour. Or a consumer might infer that a dark colour washing-up liquid might have greater efficacy than a light one (and a yellow liquid may smell of lemons whereas a green one may smell of apples). In some cases the consumer inference is not correct but nevertheless can be a primary factor that drives a consumer purchase. Colour culture relates to where it is culturally important that a product is a particular colour. For example, a bride may choose a white wedding dress, in countries brides traditionally wear white, even though she has strong personal preferences for other colours in an abstract sense. Whenever any of these primary factors are present we suggest that individual colour preferences make little or no impact on consumer purchase decisions. This could explain why in some studies it has been found that a relatively narrow range of colours is preferred

for some products [19, 30] whereas other products are frequently found (and preferred by consumers) in a very wide range of colours (such as the Apple iPod nano). In a previous study, it was found that colour preferences were a significant factor for the purchase intention of a toothbrush but not for, for example, a hand soap; [30] the colour of a toothbrush is not particularly related to its functionality, nor do different coloured toothbrushes function better or differently, nor is there any cultural or societal expectation about what the colour of a toothbrush should be. The previously published data [30] do, therefore, seem to support this new conceptual framework. However, that study was based on only 7 products and no data were actually collected regarding the primary factors illustrated in Fig. 1. Study presented herein collects data for a large number of products and explicitly tests the hypothesis that colour may be an important factor in the absence of primary colourfactors.

EXPERIMENTAL DESIGN AND METHODS

In this study a total of 54 products were selected (see TABLE I) which were household products (kitchen and bathroom) that are typically used every day. Two experiments were carried out (one online and one in the laboratory) to ascertain the colour that participants would prefer to buy for each product. In the laboratory experiment, participants were additionally asked to indicate, for each product, the extent to which they think colour could be related to performance or function. At the end of each experiment, participants were asked to indicate which colour they prefer most. The purposes of these studies were (a) to see whether the results previously obtained [30] would be found with a much larger samples (the previous study only used 7 products) and (b) to test the conceptual framework (Fig. 1) that participants will be more likely to select a product in their preferred colour when there are no primary colour factors present. (In this study, only the primary factors (colour performance and colour functionality) were considered since cultural and societal expectation for the types of products used in this study are quite weak and this was one of the reason for selecting these products.

TABLE I. The 54 products that were used in the study.

Table Cleaner	Toilet Gel	Shampoo	Cleaner	Bowl Set	Dustpan
Shower Gel	Dental Floss	Iron	Facial Cleaner	Kettle	Candle
Condom	Deodorant	Toilet Tissue	Hair Dryer	Pan	Picnic Box
Bin	Mouthwash	Tissue	Shave Splash	Scissors	Bottle Opener
Bathroom Set	Soap Bar	Sanitary Towel	Towels	Slice Toaster	Hair Brush
Coffee Maker	Toner	Face Brush	Opener	Stew Pot	Water Maker
Facial Cream	Hand Cream	Toothpaste	Tableware	Tooth Brush	Steam Cleaner
Washing Up Liquid	Laundry Detergent	Iron Casserole Pot	Hair Treatment	Bulb	Gift Set
Hand Wash Gel	Cleaning Sponge	Espresso Maker	Makeup-Remover	Chair	Mug

TABLE I about here

Each of the 54 products was digitally manipulated in Adobe Photoshop to create images in each of six colours (red, orange, yellow, green, blue and purple). For the purposes of this work very high colour fidelity was not necessary but it was important that observers would recognised the products as being either red, yellow, or green etc. The display was therefore not colour calibrated; however, since our products were defined by RGB values, the actual colours that were displayed on our monitor were measured using a Minolta CS100A colorimeter and these are reported in Table II for the colour squares and in Table III for some of the objects (Opener, Water maker, Table Cleaner, Soap Bar, Mouthwash, Tissue, Coffee Maker, Toner, Sanitary Towel, Iron Casserole Pot). Note that there is some variation in the colours of the objects (Table III) but that the different colour names are still always distinct. Fig. 2

represents visually the extent of the variability that occurred between the products.

TABLE II. The sRGB, CIE Yxy, CIE L*a*b* and CIE L*C*h* colour coordinates of the six basic colour squares.

Coloured Squares	Red	Orange	Yellow	Green	Blue	Purple
sRGB	255, 0, 0	255, 127, 0	255, 255, 0	0, 255, 0	0, 0, 255	127, 0, 255
CIE Yxy	53.50, 0.64, 0.34	86.90, 0.56, 0.40	210.00, 0.44, 0.49	155.00, 0.32, 0.59	11.60, 0.14, 0.04	28.60, 0.21, 0.09
CIE L*a*b*	40.01, 55.08, 58.27	49.84, 28.88, 64.20	72.35, -17.18, 80.75	63.85, -68.14, 69.37	17.65, 75.93, -89.76	29.46, 61.16, -63.54
CIE L*C*h*	40.01, 55.08, 58.27	49.84, 28.88, 64.20	72.35, -17.18, 80.75	63.85, -68.14, 69.37	17.65, 75.93, -89.76	29.46, 61.16, -63.54

TABLE II about here

TABLE III. The CIELAB colour coordinates for 10 of the products in each of the six basic colours in order to demonstrate the extent of the variability.

Coloured-objects	Red			Orange			Yellow			Green			Blue			Purple		
	L^*	a^*	b^*	L^*	a^*	b^*	L^*	a^*	b^*	L^*	a^*	b^*	L^*	a^*	b^*	L^*	a^*	b^*
Opener	39.05	51.81	58.11	50.49	24.40	66.52	69.30	-13.06	77.63	64.02	-64.86	69.50	21.53	77.38	-86.10	24.75	57.95	-57.77
Water Maker	38.50	51.43	49.12	46.07	29.28	56.71	69.46	-13.87	76.72	62.27	-59.46	69.85	16.86	78.33	-86.80	24.95	61.08	-58.95
TableCleaner	40.25	55.49	60.25	50.61	24.49	63.02	70.20	-14.53	76.69	62.09	-63.48	68.93	19.57	55.55	-73.95	28.21	70.13	-72.03
Soap Bar	36.16	49.77	46.31	44.43	34.20	58.60	71.36	-8.09	84.00	66.18	-63.09	68.30	25.59	64.94	-80.99	31.09	63.63	-65.02
Mouthwash	37.18	50.12	51.84	48.71	22.15	63.27	67.30	-16.77	74.02	59.69	-64.70	64.49	23.03	77.17	-87.32	27.52	68.18	-66.82
Tissue	35.30	49.58	49.75	47.38	27.51	60.29	67.77	-3.25	76.87	65.86	-69.54	70.53	21.38	53.10	-68.17	24.75	63.83	-62.56
CoffeeMaker	37.95	50.80	50.38	47.13	26.09	53.87	68.70	-16.26	69.78	63.16	-64.45	68.50	26.82	64.59	-86.99	30.75	59.02	-58.83
Toner	36.40	50.77	50.20	46.88	33.91	60.34	69.60	-11.48	71.00	63.85	-66.78	68.44	17.55	66.91	-82.12	29.30	69.53	-70.64
Sanitary Towel	37.91	52.25	52.84	44.94	28.29	58.16	67.93	-12.61	75.99	67.62	-72.44	72.17	19.91	52.57	-72.21	24.21	63.10	-67.28
Iron CasserolePot	40.08	52.54	53.94	49.02	28.04	61.50	68.08	-14.86	69.46	65.03	-65.22	74.43	18.41	44.88	-72.57	31.19	58.82	-63.04
ΔE		7.94			6.80			9.40			5.06			16.71			6.98	

TABLE III about here

Fig. 3 illustrates the coloured images for two of the products (for illustration) and also the six colour patches that were used to determine participant individual colour preferences.

For the online experiment we cannot control the settings of the displays used by the observers or even the viewing conditions. There is clearly a trade-off between colour accuracy and obtaining responses from a large number of disparate observers (typically we can carry out a highly controlled experiment in the laboratory with relatively few observers or we can carry out a large-scale experiment on the internet with many observers who may have varied backgrounds but where the degree of colorimetric control is less). However, as Moroney has noted [33], the advent of sRGB (and ICC colour-management workflows) has provided some degree of convergence in colour encoding and display for the internet. Furthermore, variability in colour appearance is likely to be significantly smaller than variability in colorimetric measurements. The choice was made to accept the limitations of colour variability in order to get responses from a diverse and large population of participants.

Fig. 2 about here

Fig. 2. The coloured images for two of the products in each of the six colour options and the six colour patches that were used to determine colour preference.

In the online survey participant was presented with the six coloured images for each product in turn (the order in which the products were presented randomly for each participant) and participant was asked to indicate (by clicking with the mouse or tapping the screen, as appropriate) which of the coloured products he/she would prefer to buy. At the end of the survey the six colour patches were displayed and participants were asked to indicate which of these was their preferred colour. The colours were chosen to have almost identical brightness and saturation so that the only variable was hue (in this study only hue is considered as a colour variable although in principle the work could be extended to include lightness and chroma).

Fig. 3 about here

Fig. 3. The coloured images for two of the products in each of the six colour options and the six colour patches that were used to determine colour preference.

The online experiment was followed by an almost identical experiment carried out in a laboratory (with controlled viewing conditions, lighting conditions, and display technology) with a smaller number of participants. In the laboratory survey a similar set of questions were asked; however, in addition participants were asked to indicate for each product the extent to which they think colour could be related to functionality or performance. Participants did this by selecting from a 5-point Likert scale (where one

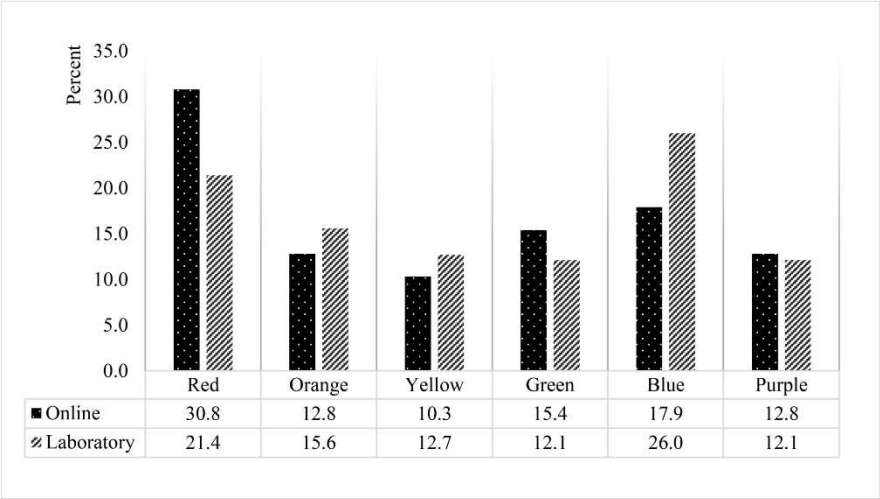
extreme was no relationship with functionality/performance and the other extreme was 100% relationship with functionality/performance). Subsequently, the scale values were assigned numbers (0 — 100%) and averaged to generate an average scale value for each product that indicates the extent to which colour is perceived to be related to functionality/performance. This experiment took place a dark room in the Experience Design Laboratory at a large public university campus in the UK. Stimuli were displayed on a HP DreamColor LP2480zx Professional Display (24-inch Diagonal LCD Backlit Monitor, the Y value of the display white was 218 cd/m^2). The size of each image was 5 × 4 mm displayed on a uniform grey background (CIE $L^* = 50$) and participants viewed the screen from about 1 m.

In the online experiment, a total of 173 participants were recruited to take part (comprising of 62 males and 111 females, and 49 UK and 73 Chinese). For the laboratory experiment, a total of 39 participants were recruited to take part, including 18 males and 21 females, and 14 UK and 19 Chinese (all participants were students or staff at the University).

For the analysis of the data, the colour that each participant selects for each product is compared with the participant's own personal colour preference. The extent to which the chosen product colour matches the personal colour preference is calculated as a per cent figure and this will be referred to as the *colour consistency rate*. This is done for each product; that is, the percent of participants that indicate that they would buy that product in their favourite colour. Since there are six different colours, chance performance is about 17%. So even if there was no effect of personal colour preference on participant purchase behaviour we would expect to find colour consistency rate of about 17% by chance. Colour consistency rates substantially higher than 17% suggest that individual colour preferences influence participant purchase behaviour for that product.

RESULTS

Fig. 4 shows the results from simply analysing which colours were preferred by the observers in the two experiments. These results are broadly consistent with those from other published studies[23] in that blue is a colour with a high preference rate and yellow is a colour with a low preference rate. There seems to be reasonable correlation between the two experiments; however, the high preference rate for red in the laboratory experiment is a little higher than that which is typically seen. Note, however, that the sample size is smaller in the laboratory experiment ($N = 39$) than in the online experiment ($N = 173$). Note also that the results in Fig. 3 are pooled over all cultures and genders for the participants.



	Red	Orange	Yellow	Green	Blue	Purple
Online	30.8	12.8	10.3	15.4	17.9	12.8
Laboratory	21.4	15.6	12.7	12.1	26.0	12.1

Fig. 4 about here

Fig. 4. The percent of participants that preferred each of the colours in the two experiments.

In the online experiment the colour consistency rate (the extent to which participants select a product in their preferred colour) was greater than 17% for every product. The average colour consistency rate was 34.2%. The lowest colour consistency rate was for the washing-up liquid (20.8%) and the highest colour consistency rate was for the Espresso Maker (48.6%). This suggests that colour preferences do affect participants' purchase decisions but that the extent of this varies between products. In the laboratory experiment the average colour consistency rate was 30.1%. The lowest colour consistency rate was for the Dental Floss (15.4%) and the colour consistency rate was for the Mug (51.3%).

Fig. 5 shows the correlation between the colour consistency rates from the two experiments. The vertical and horizontal axes represent the colour consistency rate from the laboratory experiment and the online experiment respectively. Each point on the graph refers to one of the 54 products and it is evident (r^2=0.46) that there is some agreement between the twoexperiments.

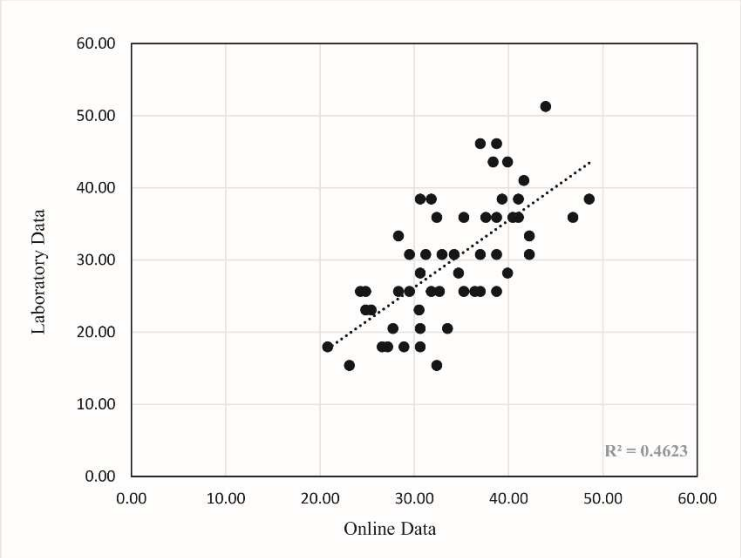


Fig. 5 about here

Fig. 5. The correlation between the colour consistency rates from the two experiments and it can be seen that the coefficient of determination (r^2) is 0.46. Each filled circle represents one of the products.

In the online experiment, some colours were very popular for certain products. If we consider products for which more than 40% of participants selected the same colour (are called popular product) then that popular products only happened for red and for blue colour. More than 40% of participants chose red for the Coffee Maker, Espresso Maker, Iron Casserole Pot, Pan, Slice Toaster and Stew Pot and more than 40% of participants chose blue for the Cleaner, Deodorant, Face Brush, Facial Cleaner, Makeup Remover, Mouthwash, Shave Splash, Iron, Toilet Tissue, Tooth Brush, Towels, Toothpaste and Dental Floss (see TABLE IV). These results are consistent with the previously published results; [30] in that earlier study blue was over-whelmingly overwhelmingly selected by participants for the hand soap product.

These data support the framework put forward in this paper (Fig 1). Interestingly that most of the products that were strongly preferred in a red colour are associated with heat (colour functionality in the framework) whereas most of the products that were strongly preferred in a blue colour are associated with cleaning and/or health (this could be colour functionality or colour performance in the framework). However, a more detailed analysis of this framework follows.

TABLE IV. A list of products for which many participants (more than 40%) selected the same colour. Note that this only occurred for red and blue.

Products	Red (%)	Orange (%)	Yellow (%)	Green (%)	Blue (%)	Purple (%)
Toilet Tissue					63.01	
Toothpaste					63.01	
Dental Floss					60.69	
Makeup-remover					54.34	
Mouthwash					53.18	
Shave Splash					50.34	
Cleaner					48.55	
Pan	47.40					
Slice Toaster	47.40					
Espresso Maker	46.82					
Facial-cleaner					45.66	
Deodorant					45.09	
Iron					42.77	
Iron Casserole Pot	42.77					
Coffee Maker	42.20					
Towels					41.62	
Face Brush					41.04	
Toilet Gel					40.46	
Tooth Brush					40.46	
Stew-pot	40.46					

TABLE IV about here

In the laboratory experiment, participants were asked to rate (using a 5-point Likert scale) the extent to which colour is related to functionality or performance for each product. The responses were averaged across all observers to produce a number (between 0 and 100%) for each product. For some products the participants judged colour to be a strong influence on functionality or performance such as for mouthwash (66.7%), washing up liquid (57.1%) and shower gel (56.4%), whereas for other products participants judged colour to be a weak influence on functionality or performance such as for scissors (13.5%), can opener (16.0%) and chair (16.7%). It is clear that for products such as mouthwash and shower gel the colour could indicate the efficacy, function, or smell of the product whereas for products such as scissors and the chair colour has no relationship with these attributes. It seems therefore that the study has effectively measured the extent of colour functionality/performance. The critical issue, however, is whether these scores correlate with the product colour consistency rate measured for the products in

the two experiments. If our conceptual framework is supported, then we would expect high colour performance/functionality scores to be associated with low product colour consistency rates and vice versa. Figs. 6 and 7 show the correlation of the colour performance/functionality scores (measured from the laboratory experiment) with the colour consistency rates measured from the online and laboratory experiments respectively. The coefficient of determination (r^2) between the colour performance/functionality scores and the colour consistency rates are 0.64 and 0.41 for the laboratory and online experiments respectively.

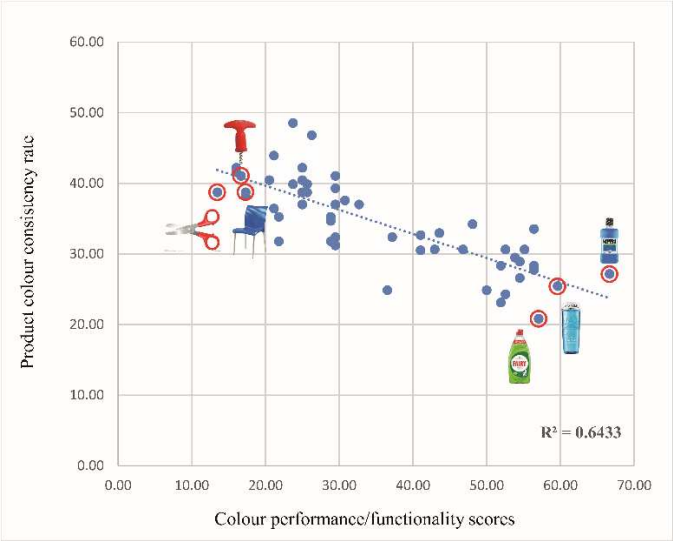


Fig. 6 about here

Fig. 6. The correlation of the colour performance/functionality scores with the colour consistency rates from online survey. Each filled circle represents one of the products (selected products are identified using an icon).

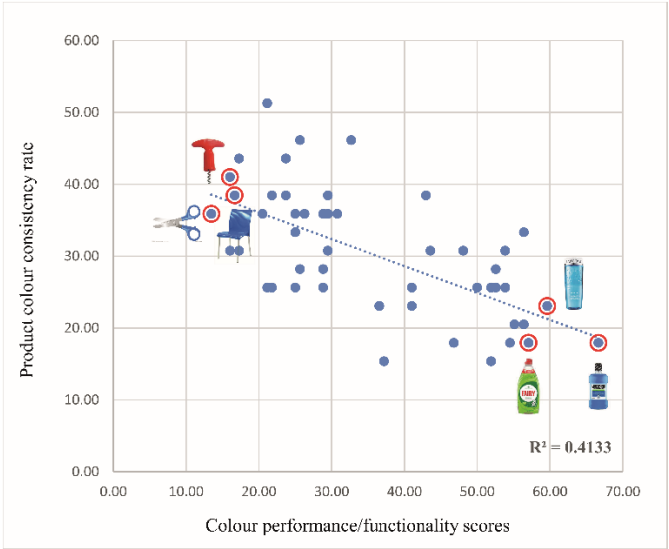


Fig. 7 about here

Fig. 7. The correlation of the colour performance/functionality scores with the colour consistency rates from laboratory. Each filled circle represents one of the products (selected products are identified using an icon).

DISCUSSION AND CONCLUSION

Colour is an important marketing tool for many products as consumers will often chose to purchase a product when it is presented with expected or preferential colours or colour schemes. Product colour preference decisions are often associated with expected performance, reliable function or other cultural factors depending on the type of the products. We refer to these as primary colour factors and suggest that a consumer's personal colour preference may be important but only in the absence of these primary factors that will otherwise drive purchase behaviour. Understanding these primary factors and the situations in which they are absent could be valuable information for professionals working in product design and/or marketing. Different types of products need differently optimised strategies for product colours to stimulate purchase decisions and an appropriate colour scheme is also valuable to build a strong brand identity. One potential practical application of this work would be to use information about an individual consumer's personal colour preferences to make a tailored proposition; for example, to present a special offer for a toothbrush using the colour that is known to be the consumer's favourite colour with the aim that this could increase the likelihood that the consumer would make a purchase. It may be possible to obtain information about a consumer's personal colour preference by analysing their social media activity or their purchase history (potentially available through store loyalty schemes).

This study investigates whether consumers' colour preferences affect their purchase-decision intentions. The data from two studies suggest that for all of the products tested participants are more likely to indicate that they would purchase a product in their favourite colour than in a random colour. By favourite colour we do not mean their favourite colour for that product but rather their favourite colour in an abstract sense (personal colour preference). However, the effect is much stronger for some products than for others and this was also found in a previous study. [30] We present a conceptual framework that suggests that consumer personal colour preferences are more likely to influence consumer product-purchase intentions in the absence of primary colour factors such as colour functionality and colour performance (the full framework is presented in Fig. 1). The data from the study are consistent with the framework and suggest a process by which it would be possible to predict in advance the products for which personal colour preferences may be important. This framework could be used as a predictor as well, especially when looking at products with multi-colour options, such as the /Apple iPod nano. Finally it is noted that this work was concerned with that aspect of colour known as hue. However, it is acknowledged that lightness and chroma may also be important for consumer purchase decisions. [11] The work in this study is also limited to household kitchen and bathroom products and it is yet to be determined whether our conceptual framework can be applied more broadly. It is clear that much more work is required in this field.

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FIGURES

Fig. 1: Schematic diagram to show the framework for this study: Individual colour preferences affect consumer colour-purchase decisions in the absence of primary colour factors such as colour functionality, colour performance and colour culture. Other primary factors could include, for example, whether a colour fits with an existing colour scheme in the home. Colour preference is only important in the absence of any of these primary colour factors.

Fig. 2: The coloured images for two of the products in each of the six colour options and the six colour patches that were used to determine colour preference.

Fig. 3: The coloured images for two of the products in each of the six colour options and the six colour patches that were used to determine colour preference.
Fig. 4: The percent of participants that preferred each of the colours in the two experiments.
Fig. 5: The correlation between the colour consistency rates from the two experiments and it can be seen that the coefficient of determination (r^2) is 0.46. Each filled circle represents one of the products.
Fig. 6: The correlation of the colour performance/functionality scores with the colour consistency rates from online survey. Each filled circle represents one of the products (selected products are identified using anicon).
Fig. 7: The correlation of the colour performance/functionality scores with the colour consistency rates from laboratory. Each filled circle represents one of the products (selected products are identified using anicon).

TABLES

TABLE I: The 54 products that were used in the study.
TABLE II: The sRGB, CIE Yxy, CIE L*a*b* and CIE L*C*h* colour coordinates of the six basic colour squares.
TABLE III: The CIELAB colour coordinates for 10 of the products in each of the six basic colours in order to demonstrate the extent of the variability.

TABLE IV: A list of products for which many participants (more than 40%) selected the same colour. Note that this only occurred for red and blue.

Biography

Luwen Yu received the Bachelor and Master degrees in Industrial Design from the School of Mechanical Science and Engineering, Huazhong University of Science and Technology, China, in 2013 and 2017. She is currently a Ph.D. student in School of Design, University of Leeds, United Kingdom. Her research interests include colour packaging, colour marketing, and design process.

Stephen Westland received BSc and PhD degrees from the University of Leeds. He has published over 150 refereed papers in areas of colour physics, colour vision, imaging, psychophysics and colour design. He is Professor of Colour Science and Technology at the University of Leeds where he leads the Experience Design research group. In 2017 he was appointed President Elect of the Society of Dyers and Colourists.

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Qianqian Pan was awarded a PhD from the University of Leeds where she now works as a Research Fellow. Her interests are colour appearance, colour measurement, lighting, psychophysical methods and computational aspects of colour.

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