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Colour Meaning and Context

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Abstract: This study compares semantic ratings of colour samples (chips) with those of the same colours applied to a variety of objects. In total, 25 participants took part in the colour-meaning experiment, and assessed 54 images using five semantic scales. In Experiment 1, simplified images (coloured silhouettes) were used whereas in Experiment 2 real images were used. In this article, the terms 'chip meaning' and 'context meaning' are used for convenience. Chip meaning refers to the associated meanings when only isolated colour chips were evaluated while context meaning refers to colour meanings evaluated when colours were applied to a variety of product categories. Analyses were performed on the data for the two experiments individually. The results of Experiment 1 show relatively few significant differences (28%) between chip meaning and context meaning. However, differences were found for a number of colours, objects and semantic scales i.e. red and black; hand wash and medicine; and masculine-feminine and elegant-vulgar. The results of Experiment 2 show more significant differences (43%) between chip meaning and context meaning. In summary, the context sometimes affects the colour meaning; however the degree to which colour meanings are invariant to context is perhaps slightly surprising and has implications for the use of colour chips in colour planning and for the generality of results from earlier colour-meaning research.

INTRODUCTION

Colour meanings have been widely researched in various disciplines including science, design, psychology, and marketing. Much colour-meaning research has used isolated colour chips as stimuli without consideration of context (i.e. without being placed in the context of a product category, for example) due to the experiments being easy and inexpensive[1-2]. Participants are typically requested to rate the colour chips against bi-polar scales such as warm-cold and masculine-feminine.[3-4] Whitfield and Whiltshire, however, have criticised the absence of the context in such colour-meaning research and argued that such research has little value due to methodological shortcomings[5]. Crozier also highlighted the importance of contextualising judgements in colour research[6].

The research that has been carried out on colour in context has led to a confusing situation. In 1957 Osgood et al.[7] asked participants to rate 6 colours on 5 objects (and as a spot colour) against 20 semantic scales and a significant interaction between colour and object was found; that is, meanings depend upon context. A later study, comparing the colour ratings of types of simulated building exteriors reported data that were somewhat consistent with those of Osgood et al. although some scales showed a greater dependence on the context than others[8]. In the context of interior architecture design, Ural and Yilmazer compared four situations such as isolated colour chips, abstract composition, 2D drawings and a simulated 3D interior space, and demonstrated that the colour meanings depend upon context[9]. Studies to explore the effect of context in room interiors have also revealed a relationship between context and colour meaning[10-11]. Also, it has been noted that pink may be associated with femininity when viewed on a baby blanket, but not when seen on a piece of bubble gum[2]. In a related field, there is growing evidence that context and experience may drive individual differences in colour preference[12]. There has also been work to suggest that there could be differences in colour associations made by professionals and laymen[13]. However, a study by Taft (1996) attested that there were few significant differences between semantic ratings on colour chips and contextual colours[1].

This work is concerned with colour in packaging of food and household goods. It is widely known that in packaging (and the often-related area of branding) colour meanings play an important role; they convey product and brand meanings. Yet, published empirical studies on the relationship between brand-packaging colour and context are rare and theoretical colour knowledge arises from the prior studies mostly without the consideration of the context[9]. Moreover, choosing isolated colour samples from design resources and then applying these decisions to real design outcomes is a widely used approach by design professionals[1,9].

The theory of colour in context has been reviewed by Elliot and Maier[2] who suggest, for example, that colour meanings (and their associated psychological responses) result from two sources (biology and learning). Elliot and Maier also note that some colour-meaning research has had methodological short-comings and especially stress the importance of using colorimetry to specify and control colours used in experiments[2].

The question that this study addresses is whether it is appropriate to use the colour-meaning resources derived from prior research or references without consideration of the specific context? The answer is unlikely to be a categorical yes or not but, rather, the question may be reformulated to explore to what extent do meanings obtained from chip colours (without context) apply to real design situations? The lack of accurate information on colour meaning in packaging and branding, and the need for such research, has been suggested in marketing[14].

Taft carried out a study to compare semantic ratings of colour samples with those from the same colours applied to a set of objects[1]. Taft found reported few significant differences between chip and object ratings for the same colour; interestingly, when such differences existed, the chip was always rated more beautiful, elegant, discreet, feminine and warm than the object colour. However, some differences were found particularly for the computer and antique chair objects, for red, green and purple colours, and for three of the scales (beautiful-ugly, discreet-loud, and elegant-vulgar). This work revisits the Taft study to some extent; however, it is focused on the effect of context on colours used in a more commercial environment (packaging) where brand awareness may also play a factor.

In this study a psychophysical experiment has been carried out to explore the relationship between the meanings of colours when viewed in context and when viewed as abstract isolated patches.

METHOD

Selection of Colour Stimuli and Bi-polar Words

In order to obtain meaningful data it is necessary to adopt a meaningful set of words (or scales) rather than using words that simply sound appropriate[15]. The contexts selected for this study were cosmetics, crisps, toilet tissue, hand wash, medicine and white wine. The scales chosen in this study were selected with consideration for the types of product packaging that were used. Thus, five words - male, warm, expensive, traditional and luxury - were selected. Some of words such as male and luxury were changed to approximate synonyms like masculine and elegant and the relevant opposite words were chosen according to the Oxford English Dictionary. Finally, the selected five bi-polar scales were masculine-feminine, warm-cold, elegant-vulgar, expensive-inexpensive and modern-traditional. The first three of these were used by Taft (1996) but Taft's beautiful-ugly and loud-discreet scales have been replaced with scales that are more meaningful for the context of this study.

Six colours were selected for study: beige, black, blue, green, red and yellow. In some sense, the choice of colours is arbitrary since it is the difference between chip meaning and context meaning that is the focus of the study, and it is simply sufficient to include a variety of colours to test that. However, red, green, yellow and blue were chosen as the four hues because they are the psychological primaries[16]; they are commonly used in packaging applications and have been associated with a number of global brands. These four primary hues were supplemented with beige and black. A number of studies[17-26] have reported associations for these six colours (see Table 1 for summary).

TABLE 1: Colour meanings for colour beige, black, blue, green, red and yellow.

Colour	Meanings	References
Beige	kindness	Grieve, 1991
	weakness	Grieve, 1991
	sickness	Grieve, 1991
	obedience	Grieve, 1991
	expensive	Kerfoot *et al.*, 2003
Black	sad	Madden *et al.*, 2000
	stale	Madden *et al.*, 2000
	fear	Aslam, 2006
	anger	Aslam, 2006
	expensive	Aslam, 2006
	hi-tech	Grimes & Doole, 1998
	death	Grieve, 1991
	old	Grimes & Doole, 1998
	power	Grieve, 1991; Aslam, 2006
	dignity	Grimes & Doole, 1998
Blue	calming	Madden *et al.*, 2000
	thoughtful	Grimes & Doole, 1998
	peaceful	Madden *et al.*, 2000
	reliable	Grimes & Doole, 1998
	expensive	Grimes & Doole, 1998
	male	Grimes & Doole, 1998
	warm	Paul & Okan, 2010
	cold	Paul & Okan, 2010
	death	Paul & Okan, 2010
	purity	Paul & Okan, 2010
	serious	Grimes & Doole, 1998
Green	reliable	Grimes & Doole, 1998; Paul & Okan, 2010
	peaceful	Madden *et al.*, 2000
	gentle	Madden *et al.*, 2000
	beautiful	Madden *et al.*, 2000
	health	Kauppinen-Räisänen, 2014
	traditional	Grimes & Doole, 1998
	inexpensive	Grimes & Doole, 1998
	safe	Grimes & Doole, 1998
	environment	Grimes & Doole, 1998
	fresh	Grimes & Doole, 1998
	natural	Grimes & Doole, 1998
Red	warm	Paul & Okan, 2010
	excitement	Hynes, 2009
	active	Madden *et al.*, 2000
	hot	Madden *et al.*, 2000

Experimental Details

Two experiments were conducted. In the first experiment to explore the effect of context, the stimuli were either images of product packaging or simple colour patches. The packaging images were simplified (to remove, for example, any brand information) so that their colour could easily be manipulated and was the only variable. In the second experiment, the simplified packaging images were replaced by the original packaging images. Although in this second experiment the packaging images were realistic, there was usually more than one colour on the packaging and other associated graphics and text that make analysis and general conclusions difficult. However, by using both simplified (Experiment 1) and real-world (Experiment 2) packaging images, it may be possible to make reliable and insightful conclusions.

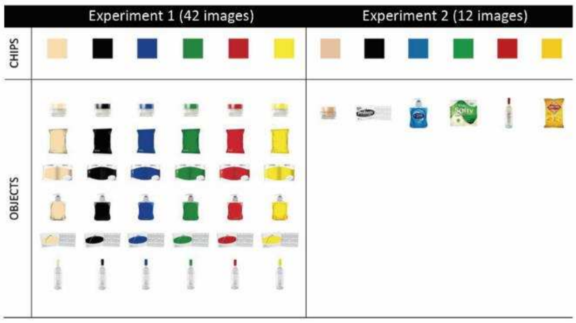
In Experiment 1, the colour of each of the simplified packaging images was manipulated to be one of the six experimental colours. These six colours were chosen from the Pantone range and when viewed as a chip colour were displayed as 6cm x 6cm patches on a light grey (R=G=B=204) background (Table 2 shows the colour names and Pantone notations used along with the sRGB colour values). In Experiment 2, each of the packaging images was shown as only one of the colours (manipulation of the colours would be difficult and would affect contrast, for example, with others in the image). The colours used in the Experiment 2 were very similar, but not identical, to those in Experiment 1 (see Table 2). The colour stimuli were specified in sRGB values and displayed in the native colour space of the display; that is, colour management was not employed, but then the actual colours that were displayed were measured (CIE Yxy values) using a spectroradiometer (Minolta CS-100A). The measured Yxy values are provided in Appendix A so that other researchers can reproduce exactly the colours used.

A total of 54 images (42 for Experiment 1 and 12 for Experiment 2) were generated as shown in Table 3. In total, 25 participants (male=8 and female=17) between the ages of 26 and 45 took part in the study. All participants were students at the University of Leeds and their nationalities were British or European (32%), Asian (52%), and Arabic (16%).

TABLE 2: Specifications of the colours used in the two phases (see Appendix 1 for colorimetric measurements).

Experiment 1			Experiment 2	
Colour term	Pantone notation	RGB	Colour term	RGB
Beige	7507	255 222 176	Beige	234 197 161
Black	black	0 0 0	Black	0 0 0
Blue	072	20 67 151	Blue	20 110 170
Green	363	32 138 60	Green	0 156 49
Red	1797	198 29 43	Red	197 0 8
Yellow	Yellow	233 239 0	Yellow	248 208 0

TABLE 3: 42 images used in part A (from top: colour chips, cosmetics, crisps, toilet tissue, hand wash, medicine and white wine) and 12 images used in part B.



Participants were screened and any who reported that they had a colour deficiency were excluded. All participants were given both written and verbal instruction about the task, and received an informed-consent form. A dark experimental room (3m x 3m) was prepared. All participants viewed the images with the same computer in the same room. Before engaging with the experiment, participants had a short practice where they rated several images against the five semantic scales to get used to the survey and the dark condition of the experimental room. The 54 images with five bi-polar scales were then presented in random order (the two experiments were interleaved). On average, each participant took about 30 minutes to complete the task. The total number of observations was 6,750 (54 images × 5 scales × 25 observers). For each observation, observers indicated the extent of the bi-polar scale for the colour being displayed using a slider bar.

Data Analysis

The raw scale bar values obtained from the experiment were averaged across all 25 observers. The mean scale values from the chip colours and context colours were then plotted and the coefficient of determination (r^2) was calculated as a measure of correlation. In addition t-tests were carried out to ascertain whether the scale values obtained for chip colour and context colours were the same. Finally a t-test was carried out between the scale values obtained from the two experiments.

RESULTS

Correlation (Experiment 1)

Figures 1-5 present the results from Experiment 1 for the scales masculine-feminine, warm-cold, expensive-inexpensive, modern-traditional and elegant-vulgar respectively. In each figure, data are separately shown for each of the six packaging contexts. On the left-hand, there is a bar chart showing the scale values (chip meaning and context meaning) for each of the six colours. On the right-hand side, chip meanings are plotted against context meanings and the correlation is indicated. For example, it is evident from the first row of Figure 1 that beige, red and yellow are judged as quite feminine for both chip colour and context colour (in the case of cosmetics) and this is reflected by a high correlation coefficient ($r^2 > 0.99$).

In Table 4 the r^2 values are summarised. Correlations higher than 0.8 are marked with light grey colour and those lower than 0.2 are marked with a dark grey colour to make visual inspection of the results easier.

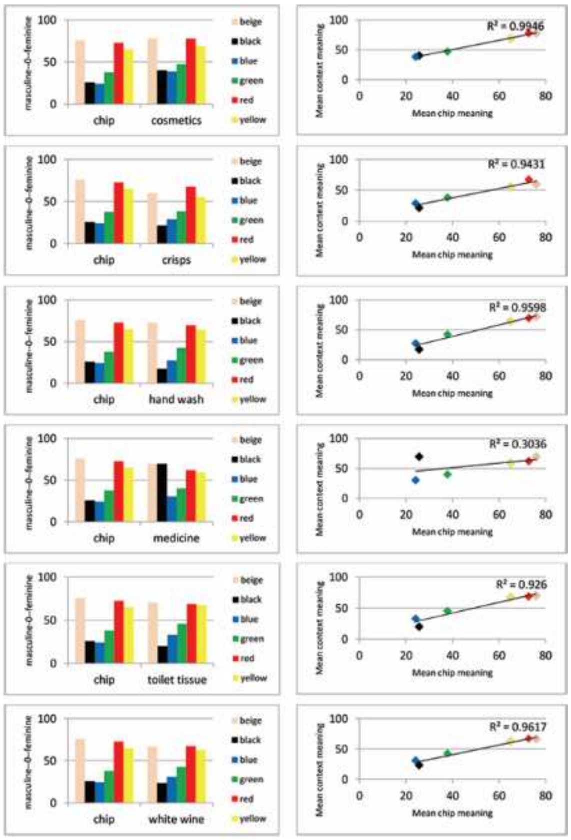


Fig. 1: Means and r^2 of chip and context meaning for masculine-feminine.

Generally, the correlation between chip meaning and context meaning is quite high; this implies quite a strong relationship between the chip meaning and the context meaning for the different colours and suggest little effect of context. However, there are some notable differences, e.g. medicine and hand wash etc. The warm-cold scale is the one where there is consistently very high correlation between chip meaning and context meaning (Table 4). Masculine-feminine also shows particularly high correlation in every case except for medicine. Modern-traditional shows the greatest variance with high correlation in the case of cosmetics and toilet tissue, much lower correlation in the case of crisps and medicine, and almost no correlation in the case of hand wash.

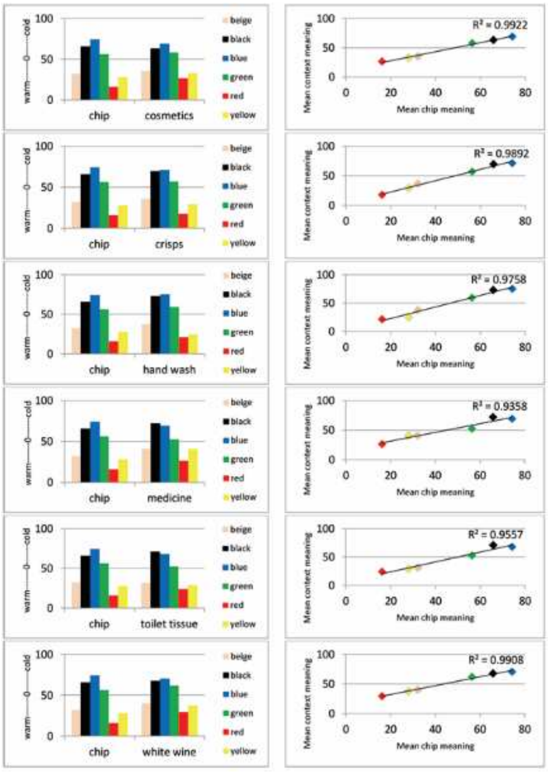


Fig. 2: Means and r^2 of chip and context meaning for warm-cold.

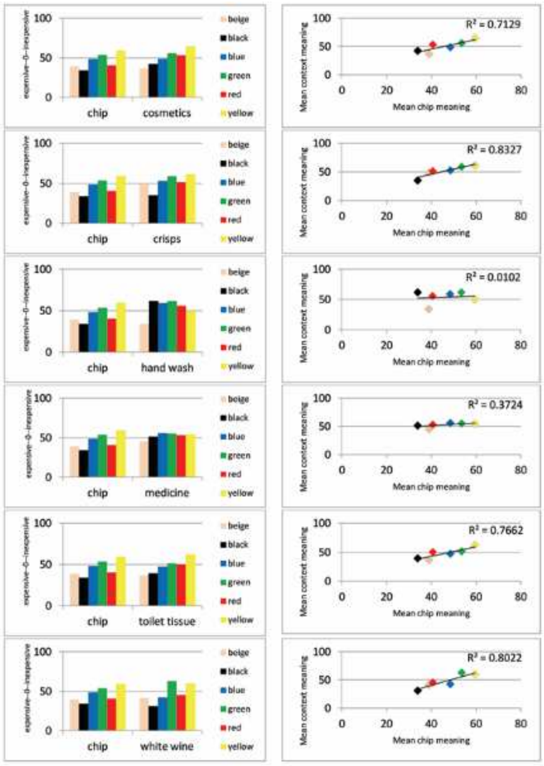


Fig. 3: Means and r^2 of chip and context meaning for expensive-inexpensive.

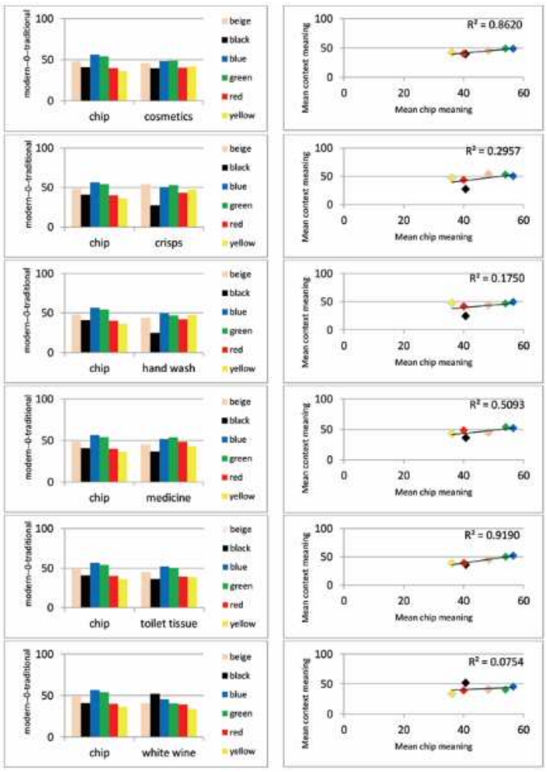


Fig. 4: Means and r^2 of chip and context meaning for modern-traditional.

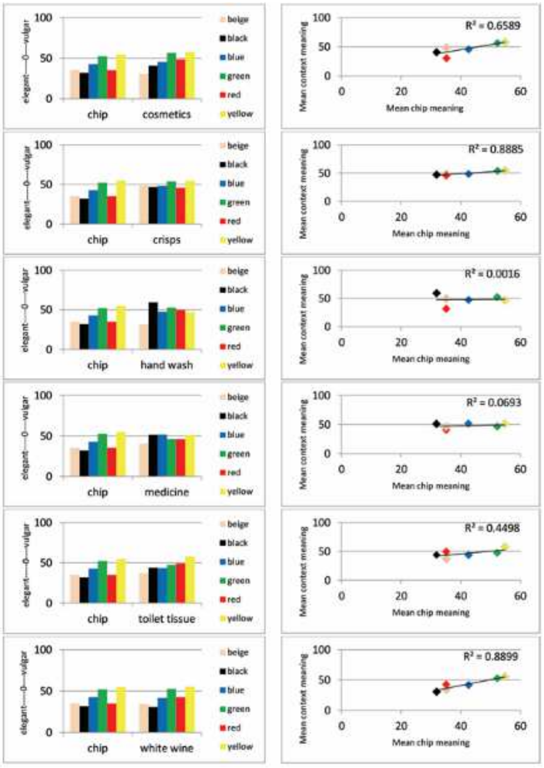


Fig. 5: Means and r^2 of chip and context meaning for elegant-vulgar.

A high correlation between two things does not necessarily imply equality between those things. For example, considering the cosmetic context (Figure 1) although there is a high correlation, the colours are generally judged to be a little more feminine for context meaning rather than for chip meaning. An additional analysis is the t-test which will specifically test to see whether the context meanings and chip meanings are the same or not.

TABLE 4: r^2 between chip and context meaning for the five semantic scales (part A).

	cosmetics	crisps	hand wash	medicine	toilet tissue	white wine
Masculine - Feminine	0.99	0.94	0.96	0.30	0.93	0.96
Warm - Cold	0.99	0.98	0.98	0.94	0.96	0.99
Expensive - Inexpensive	0.71	0.83	0.01	0.37	0.77	0.80
Modern - Traditional	0.86	0.30	0.18	0.51	0.92	0.08
Elegant - Vulgar	0.66	0.89	0.00	0.07	0.45	0.89

$r < 0.2$ $r > 0.8$

TABLE 5: T-test between chip and context meaning for five semantic scales (part A). Bi-polar words abbreviations are: M-F = Masculine-Feminine, W-C = Warm-Cold, E-I = Expensive-Inexpensive, M-T = Modern-Traditional, E-V = Elegant-Vulgar.

		M-F	W-C	E-I	M-T	E-V
BEIGE	Cosmetics	0.44	0.28	0.60	0.45	0.23
	Crisps	0.00	0.44	0.06	0.34	0.01
	Hand wash	0.21	0.15	0.23	0.30	0.45
	Medicine	0.03	0.02	0.16	0.42	0.18
	Toilet tissue	0.03	0.77	0.68	0.33	0.70
	White wine	0.01	0.00	0.52	0.07	0.83
BLACK	Cosmetics	0.00	0.53	0.06	0.87	0.03
	Crisps	0.15	0.31	0.76	0.04	0.00
	Hand wash	0.00	0.02	0.00	0.03	0.00
	Medicine	0.73	0.05	0.00	0.36	0.00
	Toilet tissue	0.04	0.31	0.12	0.35	0.00
	White wine	0.49	0.76	0.35	0.05	0.74
BLUE	Cosmetics	0.00	0.23	0.96	0.20	0.51
	Crisps	0.15	0.49	0.33	0.30	0.16
	Hand wash	0.28	0.83	0.04	0.30	0.19
	Medicine	0.02	0.23	0.06	0.41	0.02
	Toilet tissue	0.00	0.00	0.82	0.39	0.80
	White wine	0.06	0.38	0.11	0.07	0.80
GREEN	Cosmetics	0.01	0.52	0.48	0.39	0.32
	Crisps	0.89	0.81	0.09	0.81	0.74
	Hand wash	0.19	0.41	0.08	0.08	0.90
	Medicine	0.39	0.25	0.56	0.91	0.17
	Toilet tissue	0.04	0.15	0.65	0.35	0.29
	White wine	0.18	0.18	0.04	0.03	0.89
RED	Cosmetics	0.27	0.02	0.01	0.96	0.00
	Crisps	0.25	0.49	0.02	0.45	0.01
	Hand wash	0.23	0.04	0.03	0.71	0.01
	Medicine	0.00	0.00	0.01	0.03	0.00
	Toilet tissue	0.20	0.00	0.01	0.88	0.00
	White wine	0.16	0.00	0.37	0.81	0.05
YELLOW	Cosmetics	0.18	0.14	0.20	0.33	0.41
	Crisps	0.08	0.59	0.65	0.04	0.95
	Hand wash	0.85	0.25	0.02	0.07	0.08
	Medicine	0.10	0.00	0.24	0.12	0.39
	Toilet tissue	0.53	0.67	0.55	0.52	0.45
	White wine	0.41	0.03	0.94	0.56	0.88

$p < 0.05$ $p > 0.05$

Paired-sample t-test (Experiment 1)

The paired-sample t-test comparison was used to test for significant differences between chip meaning and context meaning.

As shown in Table 5, in Experiment 1 there were 180 different comparisons between chip meaning and context meaning (6 colours × 6 objects × 5 bi-polar words) and each was subjected to a paired t-test. When the p values were higher than 0.05, they were marked with light grey colour, and when they were lower than 0.05, they were marked with dark grey colour.

Statistical significance is therefore notated by a dark-grey colour. The result showed that 51 of 180 possible mean differences (that is, 28%) were significant. In 72% of cases, there was no significant difference between the chip meaning and context meaning. The greatest number of significant differences was found for red and black, for medicine and hand wash, and for masculine-feminine and elegant-vulgar.

Paired-sample t-test (Experiment 2)

Recall that whereas Experiment 1 used simplified images where the context was not very rich, Experiment 2 used realistic images that were rich in context. Table 6 explores the difference between chip meaning and context meaning for part B; the results of t-tests are shown for the 30 possible comparisons (6 colours/objects × 5 bi-polar words). The results showed that for 13 of 30 (or 43%) of the comparisons the differences between the means were significant.

TABLE 6: T-test between chip and context meaning for five semantic scales (part B

	M-F	W-C	E-I	M-T	E-V
Beige-Cosmetic	0.01	0.02	0.02	0.64	0.02
Black-Medicine	0.86	0.16	0.00	0.18	0.01
Blue-Hand wash	0.86	0.03	0.26	0.69	0.13
Green-Toilet tissue	0.01	0.00	0.17	0.99	0.43
Red-White wine	0.02	0.03	0.60	0.64	0.01
Yellow-Crisps	0.00	0.85	0.24	0.15	0.60

■ $p < 0.05$ ■ $p > 0.05$

Paired-sample t-test (Experiments 1 and 2)

Table 7 shows the results of the 30 possible t-tests that can be carried out between Experiment 1 (chip) and Experiment 2 (chip). In most cases, there were no significant differences. However, in four of 30 (or 13%) of the cases the chip meaning for Experiment 1 was different from the chip meaning in Experiment 2. In essence, this is testing whether the colours in the two experiments had different connotations (recall that the colours in the two experiments were very similar but not exactly the same).

TABLE 7: T-test between part A (chip) and part B (chip).

Colour	(M-F	W-C	E-I	M-T	E-V
Beige	0.42	0.78	0.37	0.93	0.08
Balck	0.68	0.55	0.77	0.75	0.09
Blue	0.01	0.00	1.00	0.04	0.61
Green	0.13	0.01	0.10	0.41	0.73
Red	0.73	0.05	0.58	0.25	0.05
Yellow	0.82	0.97	0.20	0.17	0.07

■ $p < 0.05$ ■ $p > 0.05$

Table 8 explores the difference in the mean ratings between Experiment 1 (context) and Experiment 2 (context). In Experiment 1 the context is simple whereas in Experiment 2 the context is more complex and realistic. Whereas Experiment 1 was carried out for each of the six colours and each of the six contexts, Experiment 2 was restricted in that each of the contexts was only shown in one colour (its original colour); that is, cosmetics was beige, medicine was black etc.

TABLE 8: T-test between part A (context) and part B (context).

Context	M-F	W-C	E-I	M-T	E-V
Cosmetic	0.19	0.01	0.70	0.98	0.92
Medicine	0.46	0.85	0.87	0.00	0.40
Hand wash	0.19	0.84	0.13	0.62	0.44
Toilet tissue	0.25	0.44	0.75	0.78	0.51
White wine	0.19	0.38	0.35	0.24	0.01
Crisps	0.14	0.62	0.01	0.41	0.29

■ $p < 0.05$ ■ $p > 0.05$

So Table 8 shows the t-test for whether the scale values for the beige cosmetic in Experiment 1 were the same as those in Experiment 2, for example. The results showed that there were no significant differences in the majority of cases with significance differences in just four out of 30 (or 13%) of cases.

DISCUSSION

This paper is concerned with whether colour meanings are affected by context. Prior research on colour meaning tends towards two contrasting perspectives; that colours have consistent meanings no matter the context in which the colour is applied, or that colour meanings change the colour is applied in a different context.

In the first experiment, 42 images (six colour chips and six objects in each of the six colours) were evaluated against five bi-polar words (masculine-feminine, warm-cold, expensive-inexpensive, modern-traditional and elegant-vulgar). In about two thirds of cases, there was no significant difference between chip meaning and context meaning with significant differences in just 28% of cases. Notable differences were found for black and red colours, for hand wash and medicine, and for masculine-feminine and elegant-vulgar (though not in every case of course). The main finding here is that colour meanings sometimes depend upon context. The data are consistent with neither of the two extreme positions (that context does not matter or that it always matters) but reflect a position somewhat between these two extremes. This finding is broadly consistent with that of Taft[1]. Taft found that that there was no significant effect of context on colour meaning in the majority of cases and that is the same as the finding in this study. Although most earlier studies also found some variability in the effect of context, many of these studies reported the main finding that context does affect colour meaning[7,9].

It is interesting to speculate why there is sometimes and effect of context on colour but not in other cases. In the medicine context, for example, the correlation between chip and context colour meaning is low in terms the masculine-feminine scale. However, as is seen in Figure 1, the difference is really only for one colour; black is scaled as being more feminine in the context of medicine than for the chip colour. One explanation is that certain colours may have very specific connotations in certain contexts. The correlation between context colour meaning and chip colour meaning is also low for medicine in terms of expensive-inexpensive and elegant-vulgar; in these cases there is little difference in the scale values for the different colours and it may be that these scales have relatively little meaning in the context of medicine.

Experiment 2 was conducted to address the potential criticism that the images used in Experiment 1 were insufficiently rich in context. It was found that the per cent of cases where there was a significant difference between chip and context meaning rose from 28% (simple context in Experiment 1) to 43% (rich context in Experiment 2). Thus the data in Experiment 2 support a greater effect of context (which is not surprising) but nevertheless more than halve of all cases showed no significant effect of context.

The key findings of this study have three implications. In design practice perspective, colour meaning information derived from past studies where colours are simplified into colour chips can be used to some extent, however, designers and brand managers may want to consider context meaning for more sophisticated design strategy. Especially, it should be careful to use colours of red and black, specifically in hand wash and medicine since these colours and are highly affected by context. In methodological perspective, in the further investigation of the colour meaning within brand packaging, it is suggested to use colour stimuli as a priority of object images used in the part A (13% differences between context meaning and real packaging context meaning, which was corrected in Photoshop), colour chips (28% differences between chip meaning and context meaning) and real packaging (43% differences between chip meaning and context meaning). In a colour tool development, the insight of this chapter recognised that a colour-meaning-centred tool, which provides accurate colour information according to the different categories, may be useful for designers and brand managers to use colour more strategically, enhance insight and strong back up for their colour decision. Also, colour chips should be organised by different product categories since some colour meanings are affected by context.

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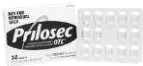
Appendix A: Yxy values measured by the spectroradiometer

	Colour	Y	x	y		Colour	Y	x	y
1		191	0.375	0.372	28		45	0.294	0.508
2		0.69	0.303	0.297	29		33.3	0.585	0.325
3		13.8	0.172	0.127	30		200	0.444	0.492
4		46.2	0.295	0.514	31		185	0.373	0.37
5		33.7	0.592	0.326	32		0.76	0.3	0.283
6		203	0.446	0.492	33		13.7	0.174	0.128
7		188	0.376	0.37	34		44.8	0.294	0.506
8		1.24	0.299	0.306	35		41.9	59.1	0.326
9		14.1	0.175	0.129	36		203	0.446	0.492
10		46.4	0.296	0.508	37		189	0.372	0.371
11		34.7	0.588	0.325	38		1.11	0.297	0.301
12		206	0.445	0.491	39		13.5	0.174	0.129
13		188	0.375	0.371	40		44.6	0.296	0.512
14		0.65	0.29	0.29	41		30.8	0.588	0.326
15		13.7	0.172	0.125	42		172	0.442	0.49
16		45.3	0.295	0.511	43		149	0.377	0.367

17		41.4	0.592	0.324	44		0.68	0.3	0.287
18		204	0.445	0.492	45		32.9	0.191	0.198
19		189	0.375	0.372	46		59.1	0.295	0.553
20		0.83	0.293	0.287	47		30.8	0.628	0.334
21		13.8	0.172	0.122	48		164	0.46	0.48
22		45.2	0.293	0.508	49		111	0.408	0.385
23		41.4	0.588	0.326	50		6.97	0.313	0.318
24		205	0.443	0.494	51		35.9	0.187	0.192
25		185	0.374	0.371	52		45.6	0.294	0.512
26		0.99	0.298	0.294	53		13.6	0.555	0.323
27		13.9	0.174	0.129	54		162	0.457	0.483