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Yu, L, Westland, S, Li, Z et al. (2021) The effect of decision time-length condition on consumer product-colour purchase decision. Color Research & Application, 46 (6). pp. 1360-1370. ISSN: 0361-2317

https://doi.org/10.1002/col.22665

The effect of decision time-length condition on consumer product-colour purchase decision

Luwen Yu,[*1] Stephen Westland,[1] Zhenhong Li,[2] Guobin Xia.[1]

[1]School of Design, University of Leeds, Leeds, UK

[2]School of Electronic and Electrical Engineering, University of Leeds, Leeds, UK

Abstract:
This article describes a developed conceptual framework for understanding consumer product-colour purchase decision in different time-length conditions. The research and method were developed the basis of research from authors' previous study. An influence element, *decision conditions* (especially, *decision-time-length*), has been introduced. The purpose of this study is to test whether the length of decision time-length affects the stability of consumers' product-colour decisions; also, to identify the relationship between the length of decision-time and how extent of colour factors working on consumers' product-colour decisions. This work employed three research activities (two-set online surveys and one-set laboratory experiment) and two research method (multiple choice for 6-alternative-forced-choice and multiple choice for rank-order) with visual component to investigate which colour a participant would choose if asked to select a product to purchase when there is a range of colours available in different time-length conditions, 64 participants were recruited to take part. The study finds that consumers might make different product-colour decisions when they are in difference shopping-time conditions. The framework suggested that consumers' individual colour preferences may be more likely to influence consumers' product-colour purchase intentions in a short-time decision-making conditions; and primary colour factors might influence more on consumer product-colour purchase intentions in a long-time decision-making condition.

Keywords: colour factors; time-length condition; packaging design; purchase decision

INTRODUCTION

Consumers frequently make purchase decisions based on visual examination, especially of product packaging [1, 2]. Product packaging has long been known to be able to invoke a consumer's imagination of a product [3]. Furthermore, colour has been suggested as one of the most powerful visual elements of packaging [4, 5, 6]. Thus, choosing an appropriate colour for the packaging might influence consumers' product decision [7]. In some cases, the packaging colour establishes a potential link between consumers and marketing. The understanding of colour is an underlying important to a packed-product with an appropriate colour in an eye-catching manner [8], or boost sale [9] or work to forecast [10, 11] or reduce product overproduction [12].

Colour has been suggested as one of essential aesthetic responses to cultivate an emotional reaction, that influences the reaction in an unconscious level (innate), semiconscious level (culturally learned or life experience) or conscious level (personal colour preference based on personal experience) [13, 14], such as feelings of attractiveness to a product [15, 16]. Colour is also an interdisciplinary major including communication [17, 18, 19], design [20, 21], marketing [22] etc. and the multifarious unconscious, semiconscious or conscious level of consumer choosing for a product-colour have been highlighted.

However, the responses for product-colour decision may not same at all time [23], even for a same product. A limited understanding of colour strategy for product-colour design in different consumers' decision conditions suggested a new for more research about colour factors and it is not clear whether colour factors have been stably utilised in product-colour/ product-packaging-colour design.

Some previous studies have considered the role of colour in product and product packaging on intended consumer purchase decisions [7, 24]. These previous studies suggested that the role of individual colour preference (that is, which colours consumers prefer in general without regard to any specific product category) is secondary to other factors, which can be defined as *primary factors*. The primary factors include *colour functionality*, *colour performance* and *colour association* (these primary factors have been discussed in detail previously). The previous studies concluded that individual colour preference affected intended product-colour purchase decision [7, 24]. Experimental data confirmed that participants are more likely to purchase a product in a colour that is their preferred colour generally compared to other colours but that the extent varies for different product categories. However, importantly, individual colour preference was shown to be secondary to primary factors such as colour functionality, colour performance or colour association. The motivation of this work is to build upon the previous conceptual framework, and to develop new insights on the *factor influence elements* that effect the extent of colour factors working on consumers' intended consumer product- purchase decisions.

Consumers' decision condition *per se* has been studied by many researchers. Kauppinen-Räisänen [23] suggested that extrinsic-product are used by consumers who are short of time, that is, consumers lack the opportunity to evaluate or compare intrinsic-products that take more time to assimilate [25, 26, 27]. Moreover, the extrinsic-product are used to connect with consumer related circumstance. Hence, consumers' product-colour decision may not stable when the situation where consumers perceive intrinsic product as complicated or they are unavailable to make a decision in there usually decision-time-length [25, 27, 28]. According to this, very little work has been carried out to explore whether consumer may provide a different product-colour choice for a same product in different decision condition (especially for time conditions), and how decision-time-length affects colour factors working on the product-colour choice. Specifically, this research is about whether the time consumers have to make decisions affects their product-colour decisions and whether the decision-time-length influences the colour factors working on consumers' product-colour choice.

FRAMEWORK FOR THIS RESEARCH

Finding a way to understand consumers' product-colour preference is important to researchers, designers and retailers [29, 30]. Previously, a conceptual framework related the effect of *individual colour preference* as secondary to primary factors (*colour functionality, colour performance, and colour association*) on consumer product-colour preferences in a normal condition [7, 24]. Some products are highly related to primary factors, otherwise, some of products are highly related to individual colour preference factor that the extent varies for different product categories. However, the extent to the colour factors relate on consumers' product-colour choices is uncertainty. Here, the *factor influence element*, which influences the extent of colour factors working on consumer's product-colour decisions, is introduced. The factor influence elements may include consumers' gender, ages, or experience for products etc. In this work, *decision condition* has been suggested as one of the factor influence elements.

The updated hypothesis is that the *decision conditions* (time-restricted or non-time-restricted decision conditions in this research) affects the stability of consumers' product-colour decision; additionally, that there is a diversified connection between *individual colour preference* and *primary colour factors* in various *decision-making time-length* conditions. The research describes both online and laboratory data for 20 products and explicitly tests the hypothesis that decision-time-length might be an element working on colour factors for consumers' product-colour choices (details see Fig.1).

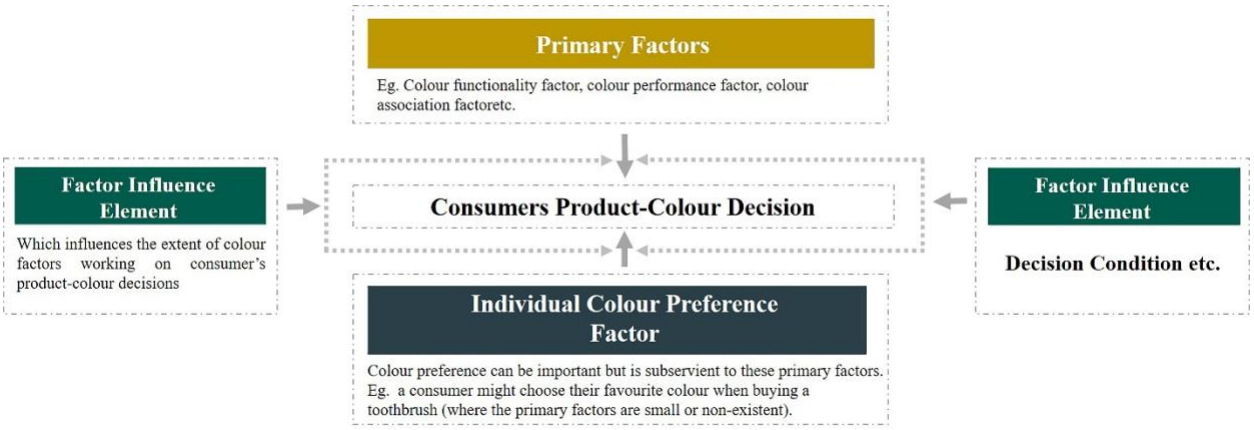

Fig. 1 The framework and hypothesis for this research.

EXPERIMENTAL DESIGN AND METHODS

This research is based on three studies (two Online Surveys and one Laboratory Experiment) to investigate the effect of decision conditions on product-colour preferences. In each of the three studies, participants were asked to complete two surveys separated in two weeks. For each survey, participants were asked to indicate their product-colour preference and their individual colour preference. In each pair of surveys, the participants' decisions were either time-restricted (forced to respond within 4 seconds) or non-time-restricted (see TABLE I). The order of the surveys (time-restricted or non-time-restricted) was different in the two Online surveys. In Online Survey I, participants completed the time-restricted survey first, then the non-time-restricted survey two weeks later and vice versa in Online Survey II. The research also explores the influence for where the experimental take place/research environment (online or laboratory / non-restrict or a dark laboratory with professional display) and the experimental order (time-restricted decision environment first or non-time-restricted). In the Laboratory Experiment, participants undertook the time-restricted experiment in the first test.

TABLE I. *Details of the three studies.*

Studies	Research activities	Time between surveys	Controlled environment	Number of participants
Online Survey I (Group I)	1) Time-restricted online survey I 2) Non-time-restricted online survey I	Two Weeks	No	20
Online Survey II (Group II)	1) Non-time-restricted online survey II 2) Time-restricted online survey II	Two Weeks	No	20
Laboratory Experiment (Group III)	1) Time-restricted laboratory experiment	Two Weeks	A dark laboratory with professional display	24

The analysis described in this paper used the data from 64 participants in total and explicitly tests the hypothesis that product-colour choice might be affected by different decision-time-length. In order to explore the extent of colour factors working on participants' product-colour intention in different decision condition, 20 products were selected for this research from a previous study (often purchased daily by consumers) [24], which obtained a low colour consistency rate for product-colour purchase decisions

(where individual colour preference does not greatly affect product-colour purchase decisions), see TABLE II.

TABLE II. *The 20 products used in this study.*

Name list of the 20 products					
Calculator	Candy	Cheese	Cream	Dental Floss	Deodorant
Hand Cream	Hand Wash	Ice Cream	Laundry Detergent	Make Up Remover	Washing Up Liquid
Shave Splash	Soap Bar	Table Cleaner	Toner	Toothpaste	Vase
Milk	Yoghurt				

In this study, six colours (red, orange, yellow, green, blue and purple) were selected from an Adobe HSB colour system [1, 31, 7]. Since different hues exhibit their maximum chroma values at different lightness values, keeping lightness and chroma constant would limit the colours to quite low chroma. Consequently, in this study there was some variation in lightness and chroma. The colours were defined as sRGB values for display and TABLE III lists these sRGB values and CIE L*a*b* (using a Minolta CS100A colorimeter) of the colours when displayed on a laboratory display.

TABLE III. *The sRGB and CIE L*a*b* colour coordinates of the six basic colour squares.*

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 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

The colours of the products were modified in Adobe Photoshop to be a visual match to the intended colours. Fig. 2 reports the actual measured colours from all objects for illustration that were displayed on the monitor, also shows the average ΔE between the product-colour and the appropriate squares colour. Furthermore, variability in colour appearance is likely to be significantly smaller than variability in colorimetric measurements. This visual-matching process introduced a small amount of error; however, observers would recognise the products as being categorically either red, yellow, or green etc [32].

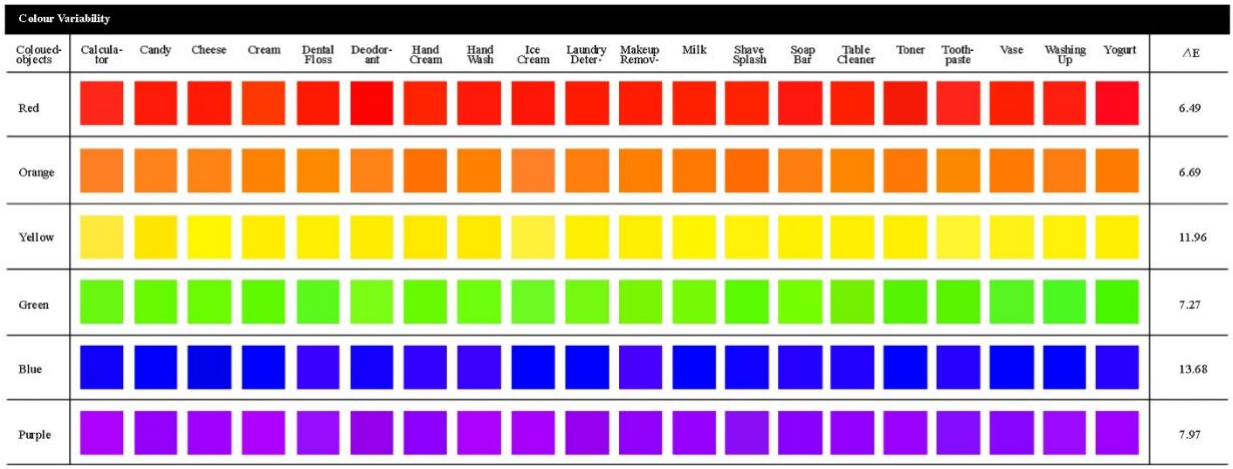

Fig. 2. The actual measured CIELAB colour coordinates from all objects for illustration that were displayed on the monitor to demonstrate the extent of the variability. The ΔE is the average colour difference between the product colours and the colour squares in TABLE III.

The online surveys were made and launched by WJX.CN through web page. The 6-AFC and rank-order research methods were employed with product-colour purchase decisions and individual colour preference questions. For the product-colour preference study, the six coloured images were simultaneously presented for each product in turn (the order in which the products were presented varied randomly for each participant) and asked to indicate which of the coloured products they would like to purchase. Additionally, in the time-restricted online surveys, if a participant did not respond in four seconds, the survey would move to the next question automatically. The time remaining for each question was shown in the left-hand corner. The laboratory experiments were made and coded using MATLAB (the response time length is recorded for all questions). For the time-restricted experiment, participants were also asked to respond within four seconds, otherwise, the buttons A to F will vanish (see Fig. 3). In this situation, participants only could click the 'NEXT' button to turn to the next question, the 'Time' is shown beyond the 'NEXT' button. At the end of each survey, the six coloured squares were displayed, and the participants were asked to indicate individual colour preference using a rank-order method (the participants clicked on each colour in order of preference). In all tests, any missing answer were not recorded as any colour.

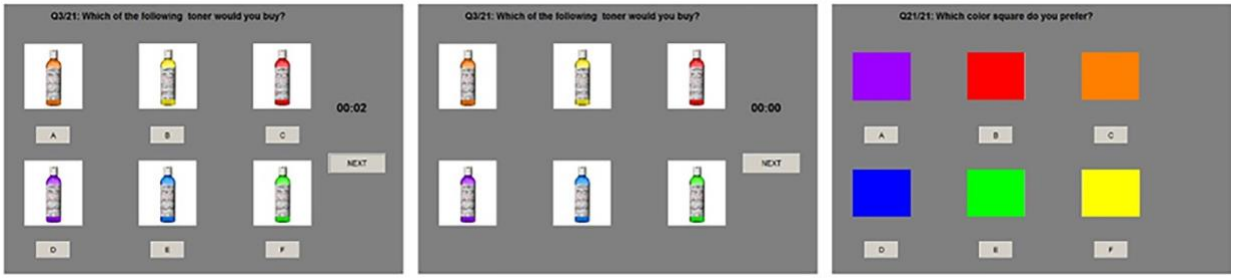

Fig. 3 Graphical user interface Laboratory experiment in which the coloured patches were presented randomly for each participant.

RESULTS

First, the effect of different experimental sequence was considered from the two Online Surveys. A test for statistically significant was carried outing using the Independent Samples T-Test to investigate whether the experimental sequence has a significant influence on participant's product-colour decision stability results. Pairwise comparisons between *the stability score* for participants' product-colour choices from Group I and Group II were carried out (*the stability score* is the extent to which the chosen product-colour from first survey matches the chosen product-colour from the second survey is calculated as a per cent figure). It was found that there was no statistical significance between two experimental sequence (p=0.597>>0.05) for the stability of participants' product-colour choices (See TABLE IV).

TABLE IV. *Statistical analysis of experimental sequence by using Independent Samples T-Test different experimental sequence for Group I and II.*

Independent Samples T-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Stability	Equal variances assumed	0.492	0.487	-0.533	38	**0.597***	-0.0243	0.04564	-0.1167	0.0681
	Equal variances not assumed			-0.533	36.466	0.597	-0.0243	0.04564	-0.1168	0.0682

In the laboratory experiment (in both test), the response-time for each question has recorded. The average response-time for time-restricted test is 2.43 seconds, and for non-time-restricted test is 5.98 seconds. In Fig. 4, the vertical and horizontal axes represent the length of product-colour decision time and participants' information respectively. Green areas represent the response-time from time-restricted test, and red areas represent the *decision increasing time* from time-restricted test to non-time-restricted test (in other words, each column represents the response-time from non-time-restricted test for each participant).

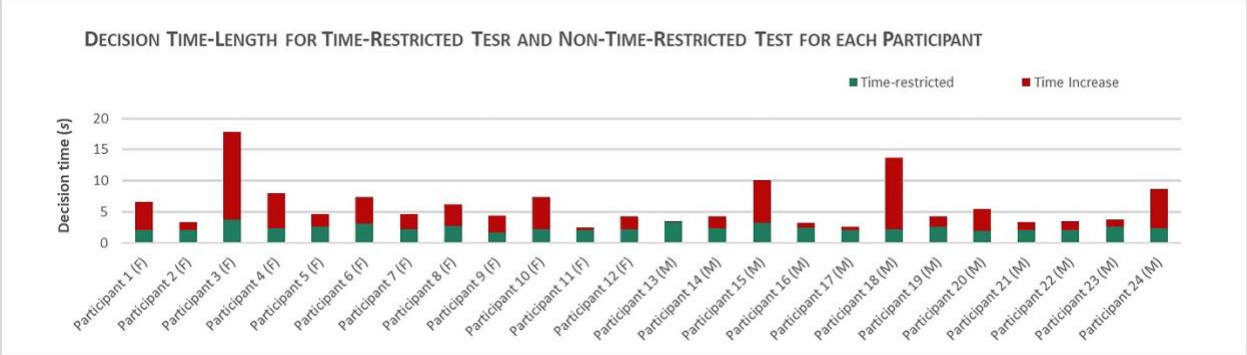

Fig. 4. The length of product-colour decision time from time-restricted test to non-time-restricted test for each participant. Green bars represent the time length for time-restricted test, each column (green bars add red bars) represent the time length for non-time-restricted test.

One of the hypothesises is that, consumer may have more stable product-colour choices in a long-time decision-making (shopping) condition rather than a short-time decision-making (shopping) condition. If this supported, between time-restricted test and non-time-restricted test, the expectation is a high increase of decision-making time to be associated with a low product-colour decision stability rate. Fig. 5 shows that may have a week negative correlation between the decision increasing time (seconds) and product-colour decision stability rates (the vertical and horizontal axes represent the increase of decision-making time (seconds) and product-colour decision stability rates respectively).

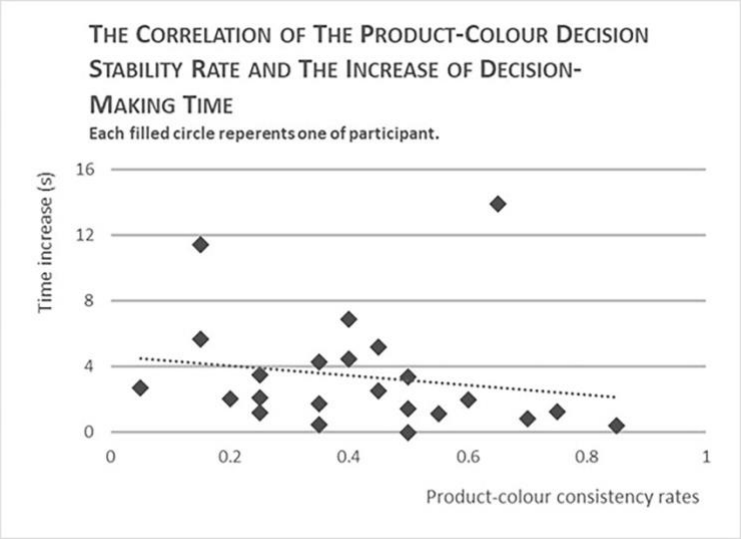

Fig. 5. The correlation of product-colour decision stability rates and the decision increasing time (each point on the graph refers to one participant).

Due to the non-normal distribution of the increase of decision-making time data (sig.=0.046<0.05), the Spearman's Correlation statistical analysis has been used (TABLE V). There is a significant corelation (sig.=0.36<0.05) with -0.43 correlation coefficient, note that this is a negative correlation. That may suggest even for different participants, the longer they take to make their decisions, the lower the product-colour stability rate.

TABLE V. *Spearman's Correlation statistical analysis of product-colour decision stability rates and the increase of decision-making time.*

Spearman's Correlations				
			Time_Increase	Stability_Rates
Spearman's rho	Time_Increase	Correlation Coefficient	1.000	-.430*
		Sig. (2-tailed)	.	.036
		N	24	24
	Stability_Rates	Correlation Coefficient	-.430*	1.000
		Sig. (2-tailed)	.036	.
		N	24	24
* Correlation is significant at the 0.05 level (2-tailed).				

For the product-colour data analysis, the product-colour that each participant select for each product is compared with participants' own individual colour preference rank-order result (for each colour-patch). From authors previous studies [7, 24], the extent to which the chosen product-colour matches the individual colour preference order is calculated as a per cent figure and this will be referred to as *colour consistency rate*. This (*colour consistency rate*) is done for each product, that is, the per cent of participants that indicate they would purchase that product in their individual colour preference (consider with their colour preference order) [7, 24]. Considering the influence of variation experimental environments (online or in the laboratory), two Independent Samples T-Test was carried out by using 64 sets of product-colour consistency rates (comparison of 41 sets of online and 24 sets of laboratory results in time-restricted and non-time-restricted conditions). These were found that there was no statistical significance between two experimental environments (p=0.051>0.05 for time-restricted condition; p=0.159>0.05 for non-time-restricted condition) for participants' product-colour consistency in both time conditions (see TABLE VI and TABLE VII). In other word, the experimental environment in this study is not a significant influence element to results.

Over all, depend on results, there is no statistically significant different on experimental sequence (time-restricted or non-time-restricted test first) or experimental locations (online or in the laboratory).

TABLE VI. *Statistical analysis of experimental environment by using Independent Samples T-Test for two time-restricted conditions.*

Independent Samples T-Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Time_restrict_colour_consistency	Equal variances assumed	0.106	0.746	-1.988	62	**0.051**	-0.0260014	0.0130797	-0.0521474	0.0001446
	Equal variances not assumed			-1.999	49.395	0.051	-0.0260014	0.0130094	-0.0521394	0.0001366

TABLE VII. *Statistical analysis of experimental environment by using Independent Samples T-Test for two non-time-restricted conditions.*

Independent Samples T-Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Non_time_restrict_colour_consistency	Equal variances assumed	4.056	0.048	-1.540	62	0.129	-0.0233021	0.0151312	-0.0535488	0.0069447
	Equal variances not assumed			-1.435	38.618	**0.159**	-0.0233021	0.0162417	-0.0561643	0.0095602

Fig. 6.1 shows the average product-colour consistency rates for participants' first preferred colour from time-restricted (green bar) and non-time-restricted (red bar) groups. The product-colour consistency rates for time-restricted and non-time- restricted were 35% and 26%. This suggests that participants prefer to choose a product with their first preferred colour in short-time decision-making conditions rather in long-time conditions. This result also shows on each study. For each group (two online groups and a laboratory group), in the short-time decision-making condition, participants tend to choose a product with the colour they more preferred. Additionally, the product-colour-consistency rate threated as rank-order for time-restricted and non-time- restricted were 35% and 26% (1st preferred colour); 17% and 19% (2nd preferred colour); 14% and 14% (3rd preferred colour); 14% and 18% (4th preferred colour); 10% and 13% (5th preferred colour); and 9% and 10% (6th preferred colour). This suggests that participants may prefer to purchase a product with the colour, both in short-time and long-time decision conditions. In other word, individual colour preference factor does affect participants' product-colour decision further (see Fig. 6.2).

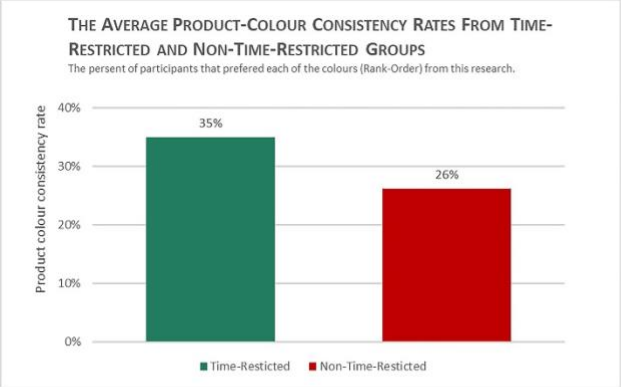

Fig. 6.1 The Average Product-Colour Consistency Rates From Time-Restricted and Non-Time-Restricted Groups.

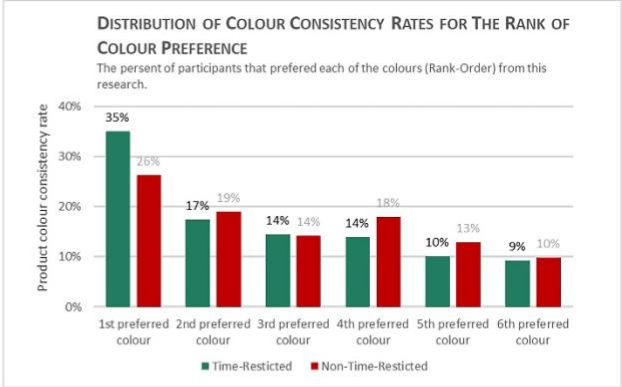

Fig. 6.2 Distribution of Colour Consistency Rates for The Rank of Colour Preference.

Fig. 6. Distribution of colour consistency rates for the rank of colour preference.

To test the influence of decision-time-length on colour preference factor, a test for statistical significance was carried out by using Paired-Sample T-Test. The Paired-Sample T-Test is used to compare two different time conditions of measurement where the measurements are applied to the same products (20 products for 64 participants). Pairwise comparisons (each participant-pair for each product) were carried out for product-colour consistency rates. It was found that there was a statistically significant difference (Sig. (2-tailed) = 0.008 << 0.05) between time-restricted and non-time-restricted conditions for product-colour consistency rates (see TABLE VIII). In other words, the decision-time condition is one of *effect element* which influence the colour preference factor working on the consumers' product-colour decisions.

TABLE VIII. *Statistical analysis of decision-time conditions by using Paried-Samples T-Test for time-restricted and non-time-restricted conditions.*

Paired Sample T Test									
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Sig. Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair	Time_restrict - Non_time_restrict	.0133367	.0391668	.0048958	.0035532	.0231203	2.724	63	.008

In the laboratory experiment, the average product-colour consistency rates for time-restricted test and non-time-restricted test were 35% and 26%. Thirteen products showed positive changes in product-colour consistency rates; on the other hand, five products showed negative changes (see Fig. 7). This suggests that consumers may tend to purchase the product-colour as their preferred colour when they were in the short-time decision-making condition (or we say in a hurry shopping condition). In other words, consumers may be more likely to purchase a product with the colour they prefer in the short-time shopping condition.

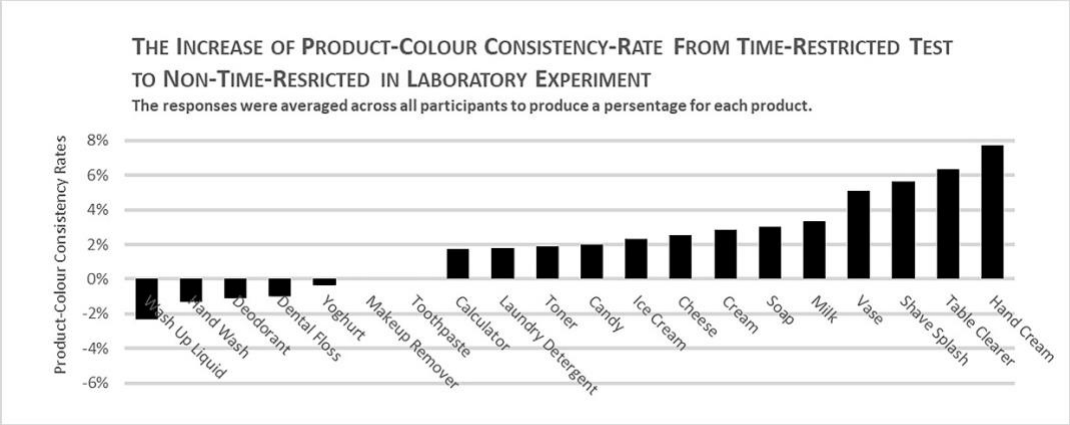

Fig. 7. The increase of product-colour consistency rates from time-restricted test and non-time-restricted test for every product in the laboratory experiment.

Comparing the difference between genders, three set of Independent Samples T-Test have been used. The average the *stability rates* for product-colour decisions response for male and female were 42% and 47%. These were found that there was no statistical significance between male and female (p=0.45>0.05) between male and female in the stability for product-colour decision in different time conditions. For the time-restricted condition, the average participants' *product-colour consistency rates* for male and female were 35% and 36%; for non-time-restricted condition, the participants' *product-colour consistency rates* dropped to 26% and 27%. These also were found that there was *no* statistical significance between male and female (p=0.51>0.05 for time-restricted condition; p=0.2>0.05 for non-time-restricted condition) for participants' product-colour consistency in both time conditions. In other words, both male and female may choose different product-colour in different time-length conditions, also, both male and female may be more likely to purchase a product with the colour they prefer in the short-time shopping condition.

The participants were asked to indicate the colour for each product within four seconds; otherwise, they were *miss-response* for this product/question. In the laboratory experiment time-control experiment, the average counts of miss-response for male and female were 1.1 and 0.7. In the laboratory experiment non-time-control experiment, the average product-colour decision-making time from male and female were 5.5 seconds and 6.1 seconds (see Fig. 8). In other words, in the time-control (time-restrict) condition, female's product-colour decision time is shorter than male; in the non-time-control condition, female's product-colour decision time is 0.6 second longer than male within these 20 products.

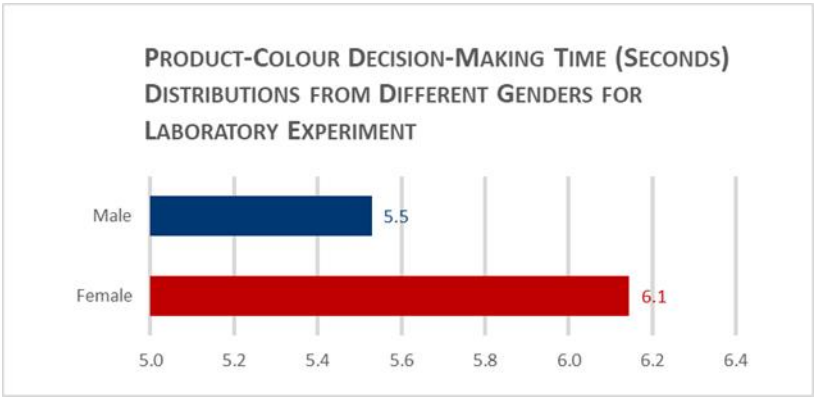

Fig. 8 Product-colour decision time distributions from different genders for in the non-time-controlled Laboratory Experiment

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 [33, 22]. From previous research, consumers' product-colour decisions are often connected with consumers' individual colour preference, expected function or performance or association depending on the type of product. Authors refer that a consumer's personal colour preference may be important but only in the absence of primary factors that will otherwise drive a product-colour purchase behaviour. However, it is limited to understand when colour preference factor works on consumers' product-colour decision and how much is it. Further exploring and understanding individual colour preference factor be valuable for professionals working in product design and/or marketing. One potential practical application of this work would be understanding consumers' purchase behaviours in different conditions. On the other hand, this work would be used as a 'work to forecast' guidance for manufactures that 'product-colour prediction' forecasts efficiently the consumer demand which are the levels of consumption, if effective demand is achieved then there is no overproduction because all inventories are sold (also to reduce out-of-stocks delivery times and the waste of various resources).

Decision conditions has been introduced as a new *factor effect element* to build the framework further, *decision time-length* has been tested in this research. The data from two online studies suggests that the experimental sequence has no significant influence or the stability of participants' product-colour choices (time-restricted or non-time-restricted first). Also, there is no significant difference on different experimental environments (online or laboratory experiment), this was found in previous studies [7, 24]. The data from laboratory experiment suggests consumer may have more stable product-colour choices in a long-time decision-making (shopping) condition rather than a short-time decision-making (shopping) condition (see Fig. 5). This research also further investigates that whether consumers' individual colour preference affect their product-colour purchase intensions. The data from three studies shows that for the products tested, participants are more likely to purchase a product-colour in their first favourite colour than their second to last favourite colour in both time conditions (or we say, long-time or short-time decision-making conditions). The new conceptual framework may suggest that consumers' product-colour choice result shows significantly different in different time conditions. In other words, the extent of colour factors working on consumers' product-colour intention may be various in different time conditions. Consumers may be influenced more by colour preference factor in the short-time shopping condition (see Fig. 1). The work also explored effect of gender on product- colour response. Pairwise comparisons show that, there was no significant different between male and female in product-colour choice stability and product-colour preference consistency in both long-time and short-time decision conditions. In the time-restrict condition, female's product-colour decision time is shorter than male; however, in the non-time-control condition, female's product-colour decision time is longer than male.

However, it is acknowledged that lightness and chroma may also be important for consumer purchase decisions. The work in this study is also limited to product categories and the number of participants whether our conceptual framework can be applied more strongly and broadly. In this work there was no significant effect of gender but we cannot rule out that a larger sample size might have found a significant effect. In addition, it is possible that the age of the participant or even their experience with a particular product category might affect their colour-decision times which could themselves be influenced by whether the shopping time is constrained in time or not. Further work should consider these factors and this could result in additional detail being required for our framework model (Fig. 1).

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BIOGRAPHY

Luwen Yu received BA and MA degrees in industrial design from the School of Mechanical Science and Engineering, Huazhong University of Science and Technology, Wuhan, China, in 2013 and 2017

respectively. She is currently a PhD student in School of Design, University of Leeds, United Kingdom. Her research interests include colour packaging, colour marketing, and design process.

Stephen Westland received BS and PhD degrees from the University of Leeds, United Kingdom. He has published widely 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.

Zhenhong Li received a BEng degree in electrical engineering from Huazhong University of Science and Technology, Hubei, China, and MS and PhD degrees in control engineering from the University of Manchester, Manchester, United Kingdom, in 2014 and 2019, respectively. He is now a research fellow in the School of Electronic and Electrical Engineering at the University of Leeds. From 2018 to 2019, he was a research associate at the University of Manchester, United Kingdom. His research interests include distributed optimization, and cooperative control of multi-agent systems.

Guobin Xia currently works as a PhD student at School of Design, University of Leeds. Prior to this, he graduated from Edinburgh College of Arts, the University of Edinburgh. His research interest emphasises the human aspect as a core problem of design through integrative studies of colour science, psychology, and immersive human-computer interaction.