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Requirements Capture for Colour Information for Design Professionals

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Abstract: This paper presents the results of a study that investigates the status of colour information use in the design process and generates ideas for a colour tool. Face-to-face interviews with senior designers and brand managers from the packaging and branding fields were conducted as the primary data collection method. The results are categorised into six topics: colour decision, types of colour information considered to be important in the design process, reasons for considering colour information important in the design process, current use of colour information, design professionals' preferences for existing colour tool types and data types and suggestions for a colour tool. It is concluded that there are problems with existing colour resources and tools regarding their availability and usefulness; there is a strong demand for a colour tool in the packaging design and branding processes. The insight from this work will help researchers, design professionals and colour tool developers to make informed decisions on the areas on which they should focus, how they should do so and why. This will facilitate better provisions and uptake of useful colour information for design professionals in the design process and strategy fields.

Key words: colour information, colour tool, design professionals

INTRODUCTION

Design information

The term 'design information' is generally defined as all the information that is used during a design process.[1] Design is an information-intensive process that includes multiple types.[2] Some design information is available in explicit or formal formats, such as catalogues, material samples, handbooks, or reports,[3] while other design information is tacit, not formally documented, and formatted based upon design know-how or experience.[4] It has been suggested that about half of the total design effort is spent carrying out tasks such as information searching, planning, communication, cost estimating, reporting, helping others, and social contact;[2] indeed, a designer may have to consider as many as 40 different types of information each minute during the design process.[5] The advantages that such resources can offer include not only supporting idea generation,[6] design decisions[7] and creativity,[8] but also saving duplication of effort and time.[3] Thus, it seems that the efficacy of the design process might strongly depend upon what information design professionals have available to use.

Colour information in the design process

Colour is a powerful visual cue in many aspects of design.[9,10] It is used, for example, to convey product or brand meanings to consumers.[11] The appropriate choice of colour for a product, packaging or brand significantly affects the delivery of brand messages, which in turn may affect consumer decision-making.[12] Considering the importance of colour in design and the advantages of information in the design process, colour information has great potential as a useful design source that helps to make colour decisions for products. However, the use of colour information may be neglected; colour often tends to be regarded as a secondary element in the design process.[13] The limited use of colour information tools in the design process could result in inferior design outcomes that have not benefited from these tools. Thus, a study of colour information in the context of design would be both necessary and helpful to improving the limited understanding of colour information. It would also better support design professionals by providing useful colour resources and tools in a usable format.

The definition of colour information

It is important to clarify the usage of the term *information* and disambiguate it from the term *data*, as they are sometimes used interchangeably. A review of the various definitions of *data* and *information* reveals the heterogeneity of the definitions and further problematises the terms. Data can be quantitative or qualitative.[14] Quantitative data are numeric; qualitative data are textual, visual and audible, as exemplified by documents, film, art and interviews. In Table 1, a review of discipline-specific dictionaries[15-19] was conducted to generate a consensus about the term *information*. In this study, the definitions were used as a basis to formulate the following: *data* can be defined as observable numeric, textual, visual and auditory properties. Raw data on their own carry no meaning. On the other hand, *information* is interpreted or processed data that contribute to decision-making or a reduction of uncertainty; it can also represent new facts or knowledge acquired by learning. In order to synthesise these conceptions of information, this study defines *colour information* as the interpretations, abstractions and knowledge about colour data in various fields, such as the natural sciences, technology, art, psychology, history and design.

Table 1: A review of discipline-specific dictionaries on the term information

	Definitions of Information
The Cambridge Dictionary of Sociology (2006)	Information may be considered on three different levels: 1) uncertainty reduction, 2) patterned abstraction, and 3) knowledge. The term connotes the recognising, creating, encoding, transmitting, decoding, and interpreting of soci al patterns
A Dictionary of Environment and Conservation (2013)	Interpreted data which is useful for making a judgement a nd drawing a conclusion
The Concise Oxford Dictionary of Mathematics (2014)	Distilled data
A Dictionary of Psychology (2015)	Knowledge obtained by learning
A Dictionary of Media and Communication (2011)	Interpreted data which contributes to uncertainty reductio n or new facts

RESEARCH AIM

This study aims to investigate the status of colour information use in the design process and

to generate ideas for a colour tool. The aim was broken down into the following research questions (RQ1–3):

RQ1. Which colour information is considered to be important in the packaging design and branding process?

RQ2. What information is used in the packaging design and branding process?

RQ3. What are design professionals' preferences and suggestions in terms of a colour tool?

METHODS

As a primary data collection method, face-to-face interviews were designed to mainly answer research questions 1–3. An online survey was designed to supplement the findings from the interviews for the first research question (Figure 1).

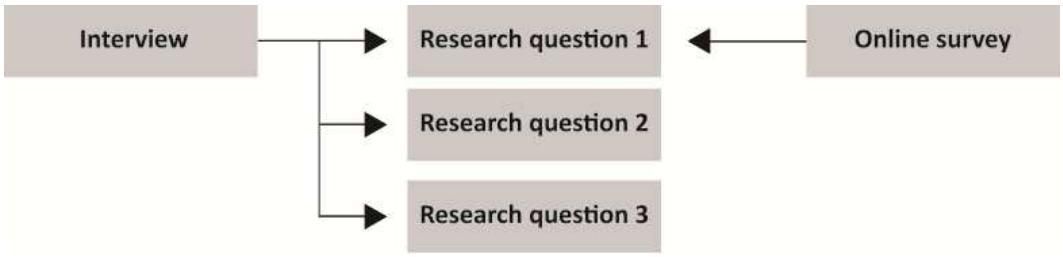

Figure 1: Data collection methods to answer research questions 1–3

Due to the scarce knowledge on colour information in design, it was difficult to start with any criteria for studying colour information. Therefore, in a previous study[20] that explored which types of colour information have been examined in academic fields, 229 journals and 10 academic books on colour were investigated using *title analysis*.[21] Specific topics and terminologies that have been used within the colour field were explored. After analysing these terms, 13 basic types of colour information were identified; these are detailed in Table 2. These terms were used as a starting point for this work.

*Table 2: Definitions of the 13 types of colour information used in this study (*alphabetical order)*

	Definitions
Colour in art and design	Colours in well-known paintings or design works
Colour harmony	Colour combinations which arouse a pleasing effect
Colour history	How a particular colour was developed
Colour and light	Principles of light, such as wavelengths and frequencies
Colour meaning	Colour meanings associated with certain colours
Colour measurement	Measuring the properties of colour or using colour measurement devices
Colour notation	Colour numbers or names to describe or communicate colour
Colour perception	How colour draws people's attention
Colour preference	People's favourite colours
Colour printing	The quality and techniques of colour printing
Colour psychology	Affective, cognitive, and behavioural responses linked to specific colours
Colour theory	Systematic frameworks and rules to explain colour
Colour trend	Colours which are on-trend or popular

Interviews

The face-to-face interviews were designed to develop an in-depth understanding of the characteristics of important colour information. A total of 10 design professionals (designers and brand managers) were recruited to participate in the study. To be eligible for the study, participants had to be senior designers or brand managers in the packaging and branding industries. Initially, 40 top UK award-winning packaging and branding agencies, nine large food companies and a colour consultant belonging to the UK Colour Group were contacted by e-mail. Two participants (one brand manager in a branding agency and one colour consultant) agreed to be interviewed in person. After these two participants were interviewed, other participants, one after another, were contacted as snowball sampling. Guest *et al.*[22] suggested that six interviews would be sufficient to collect meaningful data. Since data saturation was achieved after six interviews, we decided that 10 interviewees represented an adequate sample size for this research. All participants received an information sheet and the interview questions by e-mail prior to the interviews. The information sheet outlined

the use of the data and the participants' rights to withdraw from this study. All venues for the interviews were chosen based on the participants' preference and the ability to record their voice during the session. Before commencing the interview, an informed consent form was signed by the interviewee. The interview time was generally 40–60 minutes.

Semi-structured interviews were selected and all participants were asked 25 identical, open-ended questions. The predetermined set of questions included five criteria: participants' profile, colour decision, types of important colour information and why these types are important, current use of colour information, and preferences and suggestions. However, the interviewer asked additional questions to clarify and further expand certain issues. A card-sorting task was also employed to evaluate the importance of the different types of colour information (Figure 2).

Figure 2: Example of cards sorted by a participant

In order to collect preferences for a colour tool, a multiple-choice questionnaire was verbally administered that presented four classes of existing colour tools and six data types, as shown in Figure 3. The designers and brand managers were first asked to select any tool type or data type based on their preferences; they were then asked to provide verbal comments on their choices.

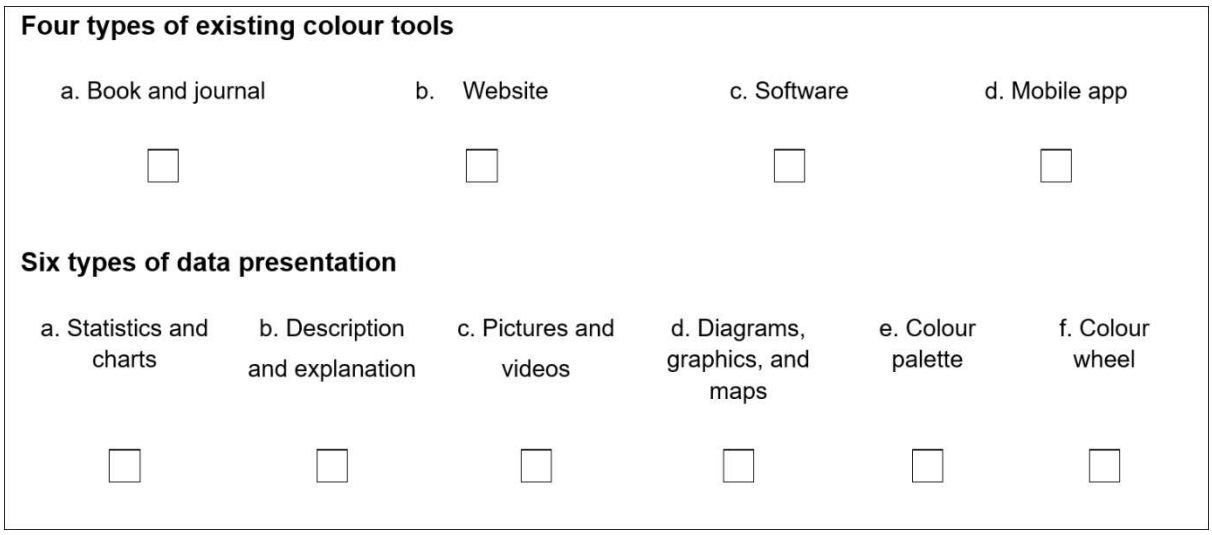

Figure 3: The questionnaire presented to designers and brand managers

A colour information tool can involve items such as books, websites, software and mobile apps. These are now briefly discussed:

- Book and journals: Non-digital tools, such as books or journals, provide reliable colour sources in a descriptive form that are based on research with a depth and breadth regarding the 13 types of colour information.
- Websites: There is a big advantage in using websites because access can be free of charge. However, as a tool, websites are highly varied in their design and therefore less reliable sources for seeking out essential information to apply to the design process and strategy.
- Software: Current colour-related software, which is another digital tool, is mostly concerned with supplying functions that find harmonious-looking colours in interior design and providing information on colour notation (e.g., Pantone codes). Although this software offers a detailed and relatively reliable level of colour information, its disadvantage is that it is sometimes not easy to access due to its expensive cost or the technical process required to install it on a laptop.
- Mobile app: A mobile app is software for mobile devices. These apps have become more and more commonplace, and have the advantages of being both handy and visual. However, most mobile applications offer limited colour information (e.g., changing the colour of personal photographs or Pantone codes), are principally used

for fun and are not always free of charge.

The six generic types of colour data presentation (see Figure 3) include statistics and charts, description and explanation, pictures and videos, diagrams, colour palette and colour wheel.

Both qualitative and quantitative data were collected and analysed during the interviews. For the qualitative data analysis, a template approach[23] was used for coding and organising data. For the quantitative data analysis, descriptive statistics were used based on frequency of selection of colour information types and preferences for colour tools and data presentation types.

Online survey

Since this online survey was designed to support the interviews, the same phrasing and pictures regarding the 13 types of colour information were used for consistency. A total of 62 people participated in the survey. Participants were recruited through various special interest groups on LinkedIn to ensure that the participants were design professionals. The identified LinkedIn groups were Graphic Design Professionals, Design Research, Graphic Design Professional Group, Colour Marketing Group, Packaging Design, Packaging Professionals, Logo Designers Collective, Packaging Connections, Package Graphic Design, Brand Management, Packaging World, Brand Innovators, Brand Lounge, Design Plus and Brand Packaging. The main questionnaire comprised 18 questions covering age, gender, design industry, years of experience and types of important colour information. For the online question regarding the types of important colour information, a direct magnitude Likert-type scale was used. A slider bar on a scale of 0-100 enabled participants to indicate how important each of the 13 types of colour information were in their design process or strategy (where 0 = no importance at all and 100 = vital). QuestionPro was chosen as the online survey creation and distribution tool.

In order to explore whether there were any differences in the use of colour information between the three groups (designers, brand managers and researchers) that participated in the online survey, a one-way analysis of variance (ANOVA) was carried out. In the comparison of the results of the interview and the online survey, r^2 (coefficient of

determination) was used to explore the extent to which the two variables were related.[24]

Participants of interviews and an online survey

This research focuses on experienced designers and brand managers as key users of colour information in the design process because senior experts are more aware of relevant and important issues.[25] Brand managers are generally assumed to be higher-level employees who are in charge of selling and sales-promotional work.[26] In this study, experienced individuals who are heavily involved in design strategies are broadly categorised as *brand managers*. Moreover, in all further discussion, the terms *design professionals*, *information users* and *practitioners* all refer to designers and brand managers. In addition, the field of design is extremely large and encompasses many industries. This study restricts itself to the category of packaging design and branding for reasons of convenience, reliability and validity.

RESULTS

The interviews and an online survey provided information on the following six topics:

1. Colour decision
2. Types of colour information considered to be important in the design process
3. Reasons for considering colour information important in the design process
4. Current use of colour information
5. Preferences of existing colour tool types and data types
6. Suggestions of a colour tool

Table 3 and the tables in supporting material (obtained from the interviews) and Figure 4 (obtained from the interviews and an online survey) summarize the key findings regarding each topic. The results obtained from the interviews were tabulated with various coded themes and indications of frequencies that were mentioned by the interviewees. For each result table, the maximum frequency was 10 (because the total number of participants was 10). No matter how many times the specific response was mentioned by one interviewee throughout the interview, it was counted as being mentioned only once. The responses most frequently mentioned are presented at the top of the list.

Colour decision

Table 3 presents how the colour decision was made in interviewees' recent design projects and the number of frequencies mentioned by them. The results indicated that colour decisions are generally made based upon a person's understanding of a brand, market and target audience. In addition, the recent design projects stated by the participants were divided into two categories: redesign projects and new projects. Some of redesigned projects concerned packaging design of global brands, so the colour decisions had many constraints. New projects were allowed a wide range of colour selections.

Table 1: Colour decisions in a recent project (obtained from the interviews)

Colour decisions in redesigned or new projects	Frequency of mentions
Understanding a brand, market, and target audience	9
Based on a design brief or client-provided information	6
Choosing a generic or differentiated colour	5
Considering what meaning the colour communicates	4
Depending on personal intuition	3

Types of colour information considered to be important in the design process

For the interview sessions, 10 senior designers and brand managers were interviewed in person regarding the most important types of colour information in the design process. For the online survey, 62 responses from designers, brand managers and researchers were collected. Although the focus of the online survey was on designers and brand managers in packaging and branding, the participants who selected the category *researcher* were included in the data set. This was primarily because they were recruited from within the packaging and branding areas identified through the LinkedIn groups; while some of them could have been professional practitioner-researchers, others could still have been potential users. In the online survey, a one-way ANOVA test was conducted (Appendix A) and revealed no statistically different responses between the three groups of participants (designers, brand managers and researchers). Therefore, the responses from the interviews and the online surveys were considered as a single population in order to compare them.

For each type of information, the average of the per cent stating that the information was

important was calculated for both the interview and the online survey (Figure 4). A degree of agreement is evident between the responses from the two methods. However, in order to quantitatively explore the relationship, the r^2 (a statistical measure of how close data are to the fitted regression line,[24] where high values imply strong correlation), was calculated. A strong agreement between the importance scores from the two studies was observed (r^2 = 0.66). Given the strong correlation between the two methods, the average importance scores were calculated for each information type; the information types *harmony, perception, meaning, psychology* and *printing* all achieved importance scores of 70% or greater.

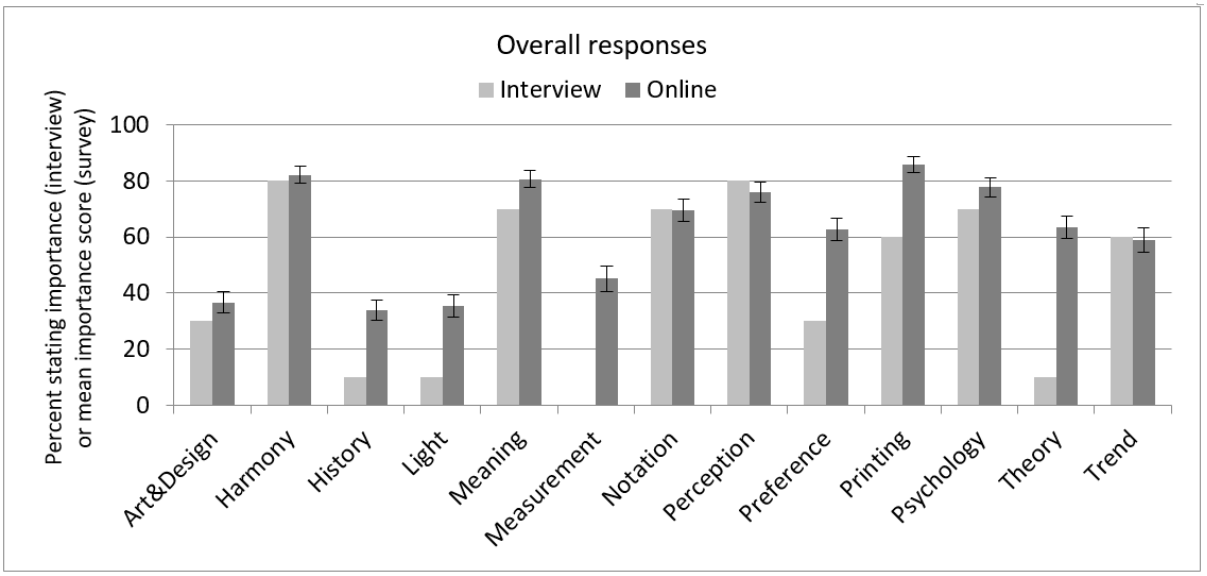

Figure 4: The results of face-to-face interviews (light grey) and online surveys (dark grey)

Reasons for considering colour information important in the design process

Supporting Table 1 presents a summary of the reasons why participants reported particular colour information to be important. The *Comments* column presents the comments provided by the interviewees regarding their choice for each type of colour information, and the *Frequency of mentions* column indicates how many times the comments were mentioned by the interviewees.

The reasons why each type of colour information is important were found to be harmony (intuitive), perception (to stand out), meaning (to convey messages), psychology (to create responses) and printing (for the end result).

One unanticipated outcome was the response for harmony. When interviewees were asked why harmony is important, they did not provide specific reasons. Rather, they stated that 'harmony is intuitive'. Intuition is tacit knowledge acquired by personal experience and not expressed openly, while explicit knowledge is documented, systematic and described using formal language.

For printing, participants reported that 'printing is the end result' and 'printing is a practical point of view'. This means that printing itself is a design outcome; thus, it appears that information on how to achieve high quality in colour printing is significant. Presumably, practical printing information relating to inks and papers would be useful.

Another unexpected outcome was the relative insignificance of the other eight types (art and design, history, light, measurement, notation, preference, theory and trend) of colour information among the original 13 types that formed the study. It was expected that art and design, preference and trend might be perceived as important by design professionals. However, participants reported that 'art and design is just a starting point in design', and 'preference keeps changing'. Moreover, many negative responses were reported for trend; participants stated 'I can predict colour', and 'It is only marketing and is unethical'.

Current use of colour information

Supporting Table 2 presents a summary of which colour information was used by designers and brand managers. The current use of colour information was reported to be very limited; a colour matching system was used by most. The main source of colour information was from self-searching or clients' briefs. Most respondents reported dissatisfaction with current available colour information. Many reported a strong demand for colour information that could be used to reinforce the colour choices that they were making.

Preferences of existing colour tool types and data types

The most preferred tool type was websites and the most preferred data type was colour palettes. Supporting Tables 3 and 4 present a summary of comments stated by interviewees in regards to the tool type and data type. The *Comments* column includes any comments made and the *Frequency of mentions* column indicates how many participants chose the

tool and data type as the most preferred.

Suggestions for a colour tool

Supporting Table 5 presents interviewees' summarised suggestions and ideas for a potentially useful colour information tool. The *Suggestions* column presents ideas offered by the interviewees for a colour tool and the *Frequency of mentions* column shows how many times the suggestions were mentioned by the interviewees.

The most desired feature for a colour tool, suggested by 6 out of 10 interviewees, was the colour meaning or predominant colour in different product categories. For the colour meaning in different product contexts, one interviewee stated the following: 'If I want to understand the Brazilian market, I need to understand what red and blue mean. If it could bring out everything in that market that uses red and blue, whether it is a flag, whether it is a government, institutions, brands. That would be a really fascinating tool for me because a lot of our work is international'. For the predominant colour in a different context, another interviewee stated the following: 'Context, it's important. One colour in crisps might have a completely different response from the same colour in cars or in laundry detergents or biscuits. If that's the way category looks at the moment, what colours might be right in terms of interruption, and why? Why might that be interesting and appropriate?'.

The interviewees wanted to know what is and what would be an appropriate colour depending on the product categories. Some suggestions were challenging, such as 'inventing a new device that could help match a colour perfectly from design to print' and 'identifying colours on the product'. Other ideas for a useful colour tool included a fully up-to-date, researched colour information and colour community site, including a conversation section, a learning section, and an inspiration section.

DISCUSSION

The evidence of this study is in line with past research, indicating that colour resources and tools are not utilised effectively[13] and need to be developed based on designers' requirements and working methods.[27-33] The results are discussed in terms of two points:

design professionals' current use of colour information in the design process and their requirements regarding a colour information tool.

Design professionals' current use of colour information in the design process

There was a clear lack of use of colour information in the design process. When asked whether interviewees used relevant colour information related to the five types of colour information (harmony, perception, meaning, psychology and printing) they chose, the majority of them hardly mentioned any formal sources or existing tools. Their current use of colour resources was mainly limited to using a colour matching system (e.g., Pantone). It may be assumed that the minimal use of colour information is because design knowledge is largely tacit, relying on personal experience or intuition rather than using formal documented information.[4] For example, designers know which colours are harmonious almost automatically through knowledge acquired from experience or by their intuition. However, Smith[34] argued that combining tacit and explicit knowledge, such as using both experience or skills and databases together, is synergetic. For example, interviewees might discuss with their clients *what* colour they chose intuitively, but the intuitively chosen colour cannot cover the *why* for their colour choice that links to a strategic or creative use of colour. If there were high-quality resources or databases for strong backup, communication with clients might be more persuasive. Therefore, to create a successful design or brand, it is suggested that the use of tacit and explicit knowledge needs to be balanced and must take advantage of both.

Design professionals' requirements regarding a colour information tool

The findings of the current use of colour information shed light on the attention to a key problem: current colour resources and tools are incapable of linking between users and useful colour sources. In response to such a noticeable gap, it is necessary to develop a useful colour tool that could offer higher quality of colour information. Furthermore, an analysis of interviewees' preferences for a colour tool showed that a website is the most preferred tool type. Thus, a web-based colour tool based upon interviewees' suggestions could provide a solution to diminish the gap between the current use of colour information and users' needs. Based on the results of the colour information examined in this study, the following recommendations for the colour information tool are suggested:

- Enable presenting content in a useful, highly visual manner for design information users, focusing on harmony, perception, meaning, psychology, and printing.
- Enable design professionals to access it easily as a web-based tool.
- Be capable of dealing with various users' preferences and suggestions.
- Provide an opportunity for both tacit and explicit colour information to be balanced.

Practical and educational implications

The findings of this study have several implications. First, the findings from the interviews indicated a great opportunity to utilise a colour tool when launching a new brand. According to responses from the interviewees, in the case of redesign projects, the main colour concern was that the brand might lose consumers by changing the original colour. In other words, the consumers have already learned the messages from the current colours of the existing brand pack; therefore, making a big colour move could cause misunderstanding or be confusing for consumers. For this reason, most redesign projects only allowed a change in tonality (e.g., keep the same hue and control brightness or chroma to make it warm or cool). This tendency indicates that great care and discretion are needed for colour decisions when companies launch a new brand, since the original colour may be retained for a long time once it has been launched. Second, this study focused on colour information for professionals, such as designers and brand managers. Future research can explore how design students are educated concerning the 13 types of colour information. If there is a gap between the important aspect of colour information and current design education, it would be worth exploring how best to bridge this gap.

CONCLUSIONS

This study has shown that there are problems with existing colour information, regarding both its availability and its usefulness. Specifically, there is only minimal use of colour information, and a gap exists between what is used and what is needed (harmony, perception, meaning, psychology and printing). In terms of design professionals' satisfaction with colour information, most respondents reported being dissatisfied with currently available colour information. Many reported a strong demand for colour information that was for the strong backup for colour choice, their ability to make quick, easy, informed decisions,

break a category norm or begin a new trial and better understand colour. The research highlights the potential for developing new sources and tools of colour information based on design professionals' preferences and suggestions.

As with all research, this study has limitations. First, as the current study employed both the exploratory and constructivist approaches, there are some limitations inherent in the research methods. Subjective opinions for useful colour information were collected from designers and brand managers based upon their actual needs. Thus, no definitive evidence of useful colour information in design can be drawn. Second, the findings might lack generalisability to different design fields, different design firms or different nations. This study collected data with 10 senior designers and brand managers in a specific context of packaging and branding in London (UK). The characteristics of the participants were robust and varied. Some of them worked for global brands, while others were employed by smaller businesses. The average amount of time participants had spent working in their lives was mostly more than 10 years. Moreover, the online survey supplemented the interviews; thus, the external validity of the findings increased. However, the fact that designers and brand managers provided particular types of information does not mean that such information can cover all design fields, such as fashion, electronics, etc., or design firms in different countries. Hence, it could be possible to collect huge datasets from different countries and different age groups of design professionals.

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Author Biographies

Seahwa Won completed her Ph.D. in colour information in design, and worked for a project which explored packaging design opportunities for healthy eating at the University of Leeds. Her research interests are design and consumer behaviour, colour design, persona design, well-being design and user-centred design.

Stephen Westland obtained his BSc and PhD from the University of Leeds and then held academic posts at the universities of Keele and Derby before being appointed as Professor of Colour Science and Technology in 2003 at the University of Leeds. During his time at Leeds he has held several management positions including Head of School of Design (2006-2013) and Acting Faculty Dean (2013). He has published over 150 peer-reviewed book chapters, journal papers and conference proceedings in the areas of colour measurement, colour imaging and colour design. He received the Davies Medal for research from the Royal Photographic Society (2008) and is currently President-Elect of the Society of Dyers and Colourists.

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