THE EFFECTS OF CONTEXT IN PRODUCT COLOR TESTING

Bryan Howell
Brigham Young University, Provo Utah, USA
✉ bryan.howell@byu.edu
Estefania Marin
Universidad EAFIT, Medellin, Colombia
✉ emarina@eafit.edu.co

SooJeong Kook
Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea
✉ kookwp1@gmail.com

ABSTRACT

This paper introduces insights into color exploration and testing methods that designers and marketers should understand in their efforts to accurately define appropriate color choices for future products.

The paper combines two independently conducted color research surveys that demonstrate how individual color preferences easily change when viewed in three different contexts. First when they are viewed as a stand-alone swatch of color, second when they are viewed on a product itself, and third when products are viewed on alternative colored backgrounds. These surveys were designed and conducted by guest researchers at Delft University of Technology.

This paper also reviews typical product color exploration methods involving color trend services, color semiotics, and traditional color wheel based aesthetic rules and explains that, although insightful, these methods are not as effective in identifying individual product color preferences as context is.

KEYWORDS: *color preference, design and marketing, product color, background color, color management.*

INTRODUCTION

Color has influenced consumers in various areas for a long time, including fashion, product manufacturing, and brand development. One of the reasons that color is such a crucial element in design is that it possesses the potential to influence a consumer's purchase by generating an emotional satisfaction or association that is meaningful to the consumer. The fact that companies such as Nike, Apple, and Christian Louboutin expend substantial resources to develop, market, and protect their color strategies, demonstrates the importance and power of effective color strategies in business (Singh, 2006; and Westland, 2013).

For example, Nike's bright yellow 'Volt' color is currently virtually synonymous with the Nike brand itself, since it is incorporated into many of the products that constitute the Nike range. Furthermore, Apple computer has required purchasers of their new iPhone 5c to select a product from a family of colors that conspicuously lacks the traditional dark grey or black color. In Christain Louboutin's case, they have trademarked their 'red sole' on high-end women's shoes and have recently garnered international news headlines regarding their arduous legal battle with their competitor, Yves Saint Laurent, over the use of red soled shoes (Buchart, 2013). These examples demonstrate the importance of, and a commitment to, product color in marketing efforts.

Generally, a color marketing strategy includes both the management of existing and future color properties as well as information regarding individual and familial color development and application to a product line and brand in order to make a profit. Applying 'any' color does not guarantee successful sales in the market. Thus, designers and marketers should be concerned with methods that will aid them in uncovering 'appropriate' colors for their products.

One of the researchers involved in this paper has significant personal experiences in defining product color palettes for a number of Fortune 500 companies. His experience shows that color decision makers often rely on the 'art' of color selection to make product color decisions. This art consists of mixing personal experience and historical product category traditions with insights from color semiotics and the psychological associations that humans make with colors, knowledge of traditional color wheel rules such as complementary and analogous color schemes, and subscriptions to color trend providers whose job it is to predict what colors are going to be popular in the market during the coming year. When a palette of potential color is selected, these color choices are then tested through a customer verification

Salamanca, J., Desmet, P., Burbano, A., Ludden, G., Maya, J. (Eds.). Proceedings of the Colors of Care: The 9th International Conference on Design & Emotion. Bogotá, October 6-10, 2014. Ediciones Uniandes, Bogotá, 2014. ISBN: 978-958-774-070-7

process or, at least, an Executive Review, which authorizes final selections.

The verifying of color preferences with users typically occurs in either a live focus group involving various color samples or using a web-based survey tool. Both scenarios allow users to consider and select which colors they prefer, thus providing the decision makers with the confidence that a robust process has been followed and that the 'right' colors have been identified.

However, two independent studies involving color preference selections have shown that user preferences for colors are easily changed based on the context that the colors are tested in. Context will be defined in this paper as the situation, environment, layout, or scenario in which color preferences are tested.

These studies demonstrate how three different contexts provide three different color preferences from users. The first context involves a stand-alone color swatch tested independently from the market category. The second context introduces the product category into the color test, and the third context changes the color of the background surface on which the product's color is tested. The result being that with each change of context, color preference also changes.

This paper argues that color decision makers need to be aware that the simple testing of color preference with people or online is not as robust as instinctively imagined. Users are easily swayed by the context in which colors are tested. Incorporating this knowledge into future color exploration and testing will increase the accuracy of color test efforts as well as increase confidence in the process that leads to the final product color selections.

COLOR TREND

Color decision makers often hire color trend consultants such as Natural Color System (NCS) or subscribe to color forecasting organizations like the International Color Marketing Group. These companies and associations are committed to investigating worldwide color trends and sources with the expectation that their knowledge and insight will provide decision makers with the necessary knowledge to make appropriate color decisions.

Data points, styles, and insights for these services are derived from various sources such as the fashion industry, architecture, music, and emerging cultural phenomenon from around the world. Based on their findings and publications, designers create inspirational color and material boards which visualize how and why certain colors should be incorporated into the final product. For example, figure one shows a color and trim board used to inform the final color for the K16 electric motorcycle.

Although these color trend sources are insightful, they are primarily starting points to begin the color exploration, which will lead to final product color specifications.

Figure 1. Color and Trim inspiration boards used to convey future color trend predictions for the K16 Electric Motorcycle.

Contrary to the argument of this paper, they freely mash contexts together to enhance the narrative they are developing. As demonstrated in the examples in figure one, the designers provide contextless color squares, which hint to a mix of product categories such as transportation, furniture and fashion. They also manipulate backgrounds to white or grey to demonstrate emerging trends. Yes, these types of exercises provide general insight into current color trends, but they provide little regarding absolute user color preferences within the product's context.

COLOR SEMIOTICS

Another common method of product color exploration used by decision makers involves color semiotics or the psychological and cognitive meanings associated with colors. Stephen Westland (2013) argues that color communicates meaning and concepts through associations and can evoke emotional responses from viewers.

For example, figure two shows various red images that each convey a different meaning through association. The red rose typically symbolizes love or passion, the red-cross equates with health care and emergency aid. The red stop sign is commonly used around the world to control traffic, while the collection of red hearts indicates a 'cute' love or valentines day. Finally, the red card is symbolic of stop, danger, and the ultimate penalty and removal from the game.

http://de2014.uniandes.edu.co | October, 2014. ISBN 978-958-774-070-7. pp. 177-183

Figure 2. Examples of how the color red is associated with different meanings. For example the rose reflects passion and love, but the small red card equals stop, danger, and penalty.

Figure 3. Red colors can also be associated with brands. Can you identify which hue belongs with Coca-Cola and which with Netflix?

Another example of color associations or semiotics involves brands. Figure three shows two different red squares, one is from the Coco-Cola logo and the other from the Netflix logo. Are consumers able to identify which color associates with which company? Yes, and consequently, brand colors are legally defendable as demonstrated by the lawsuit between Christian Louboutin and Yves Saint Laurent. The color on the left hand side of the page is Coca-Cola, the color on the right side is Netflix.

Color semiotics strongly influence consumer behavior. Studies show that customers quickly make decisions subconsciously, even before they think and compare options or features. The associations between color and connotations are made during early stages of visual processing as a key mechanism for quick decision-making and survival (Labrecque & Milne, 2011).

These associations are made by the acquisitions of memories. The memory trace (Buzan & Buzan, 2000) comes from the creation of connections between neurons that represent associated stimuli. Perception of products comes from memories or the relationship among emotions and colors. Consequently, people tend to choose colors they associate with emotions that are meaningful to them, for example, yellow and cheerful (Labrecque & Milne, 2011).

The associations of colors and emotions are also directly connected with the visceral state of the person at the time of choice (Lee et al., 2011). The visceral level of product perception is the relationship between the impact of the appearance and the emotions evoked from a product that is related directly with the consumer's cultural background.

The semiotics of colors can be used in various ways in product design, and designers should understand the basics of the principles and incorporate them in color explorations. However, the meanings people associate with colors vary depending on things like culture, religion, and regional traditions; they are neither consistent nor predictable. Although understanding the issues surrounding the notion of color semiotics is important, it is not a robust method to identify consumers' final product color preferences.

COLOR WHEEL HARMONY RULES

Another way to explore families of potential product colors is to use traditional 'color wheel' based theories. A 'color wheel' is the range of colors in a circular spectrum that shows relationships between different visible colors. It was developed three hundred years ago and has been used as a foundation for a variety of color theories ever since (Westland, 2013).

There are several schematic color groups that are known to be effective in color theories. Johannes Itten (1961) promotes in his book *The Art of Color* such combinations as, triad, analogous, and compound schemes. He further explains these to be rules that artists can use to provide an aesthetic appreciation regarding colors.

Nowadays, digital web-based color wheel tools such as Adobe Kuler (2014), as shown in figure four, have been invented and used by many designers and marketers to aid in color family development. The color tool's meticulous calculations quickly provide numerical and visual results for a number of classic color scheme rules and allows users to create new schemes of their own.

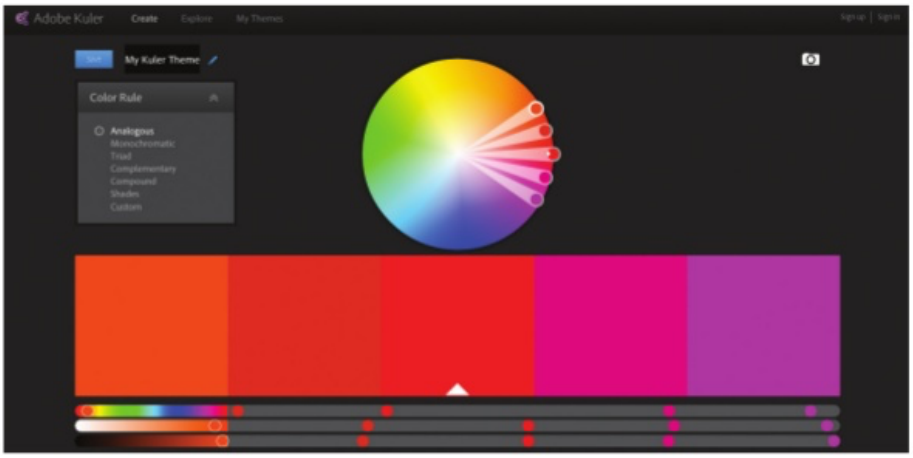

Figure 4. The web based Adobe Kuler Program incorporates the traditional color wheel to both visualize and quickly explore a variety of color rules. The image on the left displays an Analogous color rule while the image on the right displays a Triad based color rule.

Although this tool is fun to use and provides respectable and quick predefined color relationships, it is limited in its ability to aid color decision makers to accurately test perception of a product's color. Primarily, this tool allows designers to explore color relationships and to numerically define color specifications.

COLOR PREFERENCES

A number of studies have been done related to color preferences in humans. They typically test color preferences in a contextless situation. Other studies demonstrate that individual preferences will vary depending on the environmental colors applied in a retail situation. However, in regard to color preferences on products, there are few research articles to review.

For example, Holmes & Buchanan (1984) teach us that color preference of an object cannot be found independtly of the object. Another example is Saito's (1983) work which found color preference changed when measured with and without a context.

Stephen Palmer from the department of Psychology at the University of California at Berkley has performed a number of such studies, including one on 'Object Color Preferences' that was recently published in April of 2012. From this study, Experiment Three is of particular note to this paper. This experiment indicates that there is no difference in color preferences between imagined, depicted and actual objects. Palmer's recommendation is challenged by the findings presented in this paper, which argue that context, the situation, environment, layout, or the scenario in which color preferences are tested makes a significant impact on color preference.

INDEPENDENTLY RUN COLOR RESEARCH SURVEYS

With these notions of context in mind and to aid in understanding the affects of color preferences in and out of context, tests from two different researchers were performed and analyzed. Because the tests were performed independently from each other, the data sets are not perfectly aligned, and one includes information on proportion that is not necessarily critical to this paper's position. However, in general both tests contribute substantially to the paper's position.

TEST 1: THE "CONTEXTLESS" COLOR SWATCH TEST

In this study, a questionnaire on color preferences was created and invigilated using online methods. A selection of twelve colored squares or swatches were chosen to obtain a broad range of color choices, including black and white. The respondents were between the ages of 19 and 35, from European, American and Asian cultural backgrounds with the ratio between male and female at 1:1.2, or roughly evenly distributed.

Figure 5. These are the contextless color swatch samples used to obtain preferred and not-preferred color choices from respondents.

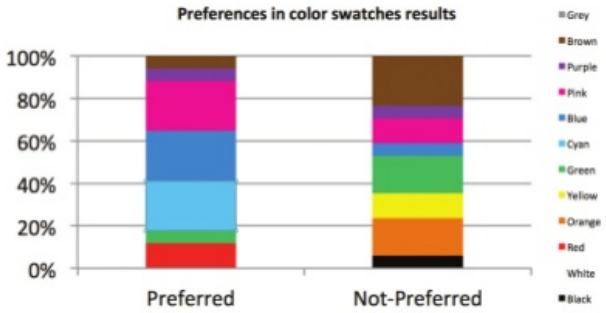

Figure 6. Results for preferred and not-preferred contextless color preference study.

Participants were asked to pick a color they liked and one they disliked from 12 color squares presented to them on a white background as shown in figure five. Participants were not provided or requested to imagine a context for the colors, they were simply asked to identify their personal 'preferred' and 'non-preferred' colors. This sets a foundation from which to demonstrate how color preferences can vary in follow-on tests and exposes respondents to the notion of personal color preferences.

Results of the "Contextless" color swatch test

The results of the test show that the majority of participants liked a blue-tone color such as cyan #7 and blue #8 from the figure above. There appears to be no noticeable preference differences based on the respondent's culture backgrounds. Many respondents disliked the orange #4, green#6, and brown #11colors. See figure six below for the overall results.

These findings basically align with those proposed in Palmer and Schloss's (2010) Ecological Valence Theory. This theory proposes that people prefer colors that are associated with positive experiences, such as the color blue associated with blue skies, and dislike those colors associated with negative experiences like rotting vegetation and excrement such as dark browns and yellows.

TEST 2: THE COLOR "IN CONTEXT" TEST

In test two, both a product category and form were added and considered by respondents in their color preference selections. A collection of the ten most recent Apple iPhones were used as colored objects in order to test color preference. The iPhone's original colors were not modified in any

http://de2014.uniandes.edu.co | October, 2014. ISBN 978-958-774-070-7. pp. 177-183

Figure 7. Images of the ten Apple iPhone colors used to provide context for the color preference test.

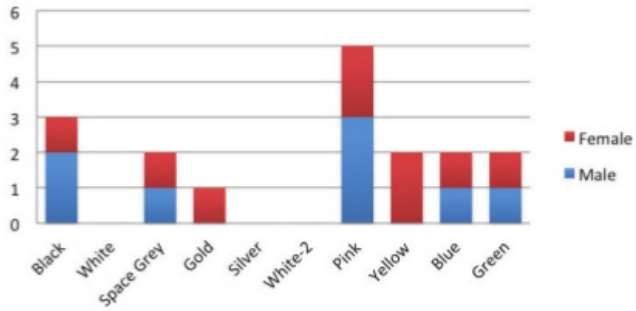

Figure 8. These charts show the 'most' preferred and 'least' preferred colors results from testing with an iPhone providing the context.

way. However, a material change from metal to plastic occurs between the first group of five phones, numbers one to five, and the second group of five phones, numbers six to ten. This change in material and texture could have an impact on the color preference but was not explored in these tests. The iPhone color samples are shown in Figure seven below.

The respondents were asked to perform a series of color selection exercises involving the neutral colors and the metallic colors and finally were asked to identify their 'most preferred' and 'least preferred' colors from all ten samples.

Results of the color 'in context' test

The results shown in figure eight below indicate that gold #4, silver #5 and space grey #3 colors are the most preferred, and that pink #7 is the least preferred. The survey also identifies gender color preferences as well, and although this separation is interesting and worth further study, it is not pursued in this paper's argument.

These findings show a significant difference from the findings in test one, which tested contextless colors. Whereas the palette of blue and pink colors were preferred 'out of context', when put 'in context', they did not perform nearly as well. In fact, the pinkish hue was the least preferred of all available colors in this particular context. Although the hues were not identical in the two tests, this demonstrates that providing a context causes identical respondents to alter their color preferences from previously measured contextless surveys. It would be advisable to further explore the effect of category on color preferences. For example, a test involving the same colors and textures, but changes in the category from mobile phones to another consumer electronic category, such as personal computers or home media players, might uncover how category affects color preference.

TEST 3: THE COLOR ON 'DIFFERENT BACKGROUNDS' TEST

Test three examines how different colored backgrounds, employed when testing the color preference of objects, affects test subjects' color preference. A second researcher, not in direct collaboration with the first researcher mentioned in this paper but exploring a similar topic, performed this test. Consequently, the numbers of respondents and type of questions being asked are somewhat different then previously shown.

This test was performed using an online survey and included forty respondents between the ages of 18 and 28, from European, Central American, and Asian cultural backgrounds.

A collection of seven product attributes was selected against which to measure product perceptions. The attributes, created with input from peer Industrial Design researchers and insight provided from the writings of an online expert reviewer (Finnamore, 2013), are: elegant, classical, male, simple, dynamic, childish, and bright. The survey consisted of four different image sets of a green iPhone that had been manipulated to show four different color proportion combinations. These iPhone image sets were displayed on a white background in one scenario and a dark wood background in the second scenario. These two scenarios where then measured against the list of product attributes. For this paper, the proportion data from this study will not be further discussed. However, the product attribute data generated by the testing is directly applicable to our argument.

In the survey, respondents qualified each set of iPhones using the attribute list. They could only match one attribute with any one of the four image sets. In the first set of questions the green iPhone sets were displayed against a white background as shown in figure nine, below. Intuition suggests that this white colored background is neutral and will not influ-

Figure 9. iPhone sets on a white background, with corresponding attribute data. High scores are highlighted in green.

Figure 10. iPhone sets on a dark wood background, with corresponding attribute data. High scores are highlighted in green.

ence color preferences. Interestingly, it also simulates the typical white table found at Apple stores where products are displayed.

In the second set of questions the identical green iPhone sets were displayed against a dark wood background as shown in figure ten, below. Identical questions were asked in this second set of questions as in the first set of questions. Intuition, in this case, suggests that a simple background change should not alter the perceived qualities of a tested product.

Results of the color on 'different backgrounds' test

As can be seen in the two charts, the exact same iPhone sets received different attribute responses based only on differing backgrounds. Every response but one, the Male attribute in option four, changed in its perceived quality. Of the high scores, three of them, Male, Simple, and Childish, post a difference of 22% to 30%, while Dynamic and Bright show a 13% and 16% difference respectively. The remainder, Elegant and Classical show a 5% and 9% difference.

From this evidence it can be concluded that background choices influence perceived product attributes and consequently, could also influence product color preferences. It is interesting to speculate on why this occurred.

One researcher suggests that this phenomenon is similar to Johannes Itten's (1961) teaching on 'simultaneous color contrast'. He teaches that human eyes physiologically attempt to counter balance whatever color we are looking at with its complement. This effect cannot be photographed or observed outside of our minds. It is a natural physiological occurrence and causes us to perceive colors differently based on the environment in which the color is viewed. This theory provides an example of how a background can influence a product's color perception.

Another researcher suggests that changing the background from white to wood alters the values and associations regarding the material and intrinsic properties of the product. For instance, the green iPhone on a wood background could suggest an 'ecological' association, while a silky black textured background would convey a 'luxurious or sensual' association. These different associations affect intrinsic values in the respondents, which are then manifest in their preference selections.

CONCLUSION

Color selection for products is a difficult task at best. Color decision makers search for clear, simple and robust methods of color development and selection that provide appropriate, motivating, and convincing solutions to both internal development teams, and the end consumer.

This paper has demonstrated that evaluating color preferences in different contexts has an impact on respondents' color choices. Color swatches, when tested independently of the product prove to be highly misleading as a product color choice indicator. For example, the blue family proves to be the preferred color family when tested against other colors in a contextless environment. However, when similar colors are tested within a specific context, in this case mobile phones, color preferences change from blues to formal colors such as, gold, silver, and grey.

This paper also suggests that the background colors used behind a product are not inconsequential in color preference testing. The testing has shown that alternative backgrounds cause changes in attribute assignments related to colors. For example, the results of identical iPhone product sets tested on a dark wood background will not produce matching results when they are tested on a white background. The difference in the two scenarios is not insignificant and deserves further study as to why and how this occurs.

Finally, it can be argued that differing contexts, defined in this paper as the situation, environment, layout, or scenario in which color preferences are tested, clearly influence color preference among test respondents. Thus it becomes beneficial for designers, marketers, and other decision makers, to depend on more than their intuition in pursuing color choices. They need to understand and manage color choice through context in order to accurately develop and test product colors.

REFERENCES

Bucolo, S., and Matthews, J. (2011) 'Design-led Innovation—Exploring the synthesis of needs, technologies and business model', in: Buur J. (Ed.), *Proceedings of the Participatory Innovation Conference*, 13-15 January, Sønderborg, Denmark, pp.351-354.

Adobe Systems. 2013. '*Adobe Kuler* [Online]. Available at: https://kuler.adobe.com/create/color-wheel/ [Accessed: 4 April 2014]

http://de2014.uniandes.edu.co | October, 2014. ISBN 978-958-774-070-7. pp. 177-183

Buzan, T. and Buzan, B. (2000) *The Mindmap Book*. London: BBC press.

Burchart, T. (2013) *Christian Louboutin v. Yves Saint Laurent - No End to Their Trademark Battle Over the Color Red?* Expert Review [online]. Retreived from: http://www.lexisnexis.com/legalnews-room/intellectual-property/b/copyright-trademark-law-blog/archive/2013/01/30/christian-louboutin-v-yves-saint-laurent-the-trademark-battle-for-the-color-red-may-continue.aspx

Finnamore, C. 2013. *Best mobile phones to buy in 2013*, Expert review. [Online] Available at: http://www.expertreviews.co.uk/smartphones/1296334/best-mobile-phones-to-buy-in-2014 [Accessed: 4 April 2014]

Holmes, C.B., and Buchanan, J. A. (1984) 'Color preference as a function of the object described', *Bulletin of the Psychonomic Society*, 22, (5), pp.423-425.

Itten, J. (1961) *The Art of Color*. New York: Van Nostrand Reinhold Company.

Lee, M.K., Kiesler, S., and Forlizzi, J. (2011) 'Mining Behavioral Economics to Design Persuasive Technology for Healthy Choices', *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pp.325-334.

Labrecque, L.I., and Milne, G.R. (2011) 'Exciting red and competent blue: the importance of color in marketing', *Academy of marketing science*, pp.1-3.

Palmer, S.E., and Schloss, K.B. (2010) 'An ecological valence theory of human color preference', *Proceedings of the National Academy of Sciences*, 107, (19), pp.8877–8882.

Saito, T. (2013) 'Latent spaces of color preference with and without a context: Using the shape of an automobile as the context', *Color Research & Application*, 38, (6), pp.393–411.

Schloss, K.B., Strauss, E.D., and Palmer, S.E. (2013) 'Object Color Preferences', *Color Research & Application*, 8, (2), pp.101–113.

Singh, S. (2006) 'Impact of color on marketing', *Management Decision*, 44, (6), pp.783-789.

Westland, S. 2013. *Colour semiotics – a personal view*. [Online] Available at: http://colourware.wordpress.com/category/advanced-stuff/ [Accessed 4 April 2014]