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The impact of color in the e-commerce marketing of fashions: an exploratory study

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Abstract *As the number of Internet purchases of fashion items increases, the problem of inaccurate color representation on the Web becomes more significant. Color inaccuracy has many negative consequences for marketers, including loss of sales, increased returns and complaints, and customer defections. This research reports the findings of a survey conducted as part of an initial investigation into consumer opinions about fashion merchandise purchasing over the Internet. Results indicate that companies are losing customers and sales as a result of having colors on e-commerce sites that do not accurately represent the actual colors of the products being sold. Increased dissatisfaction on the part of consumers leads to greater costs in both customer service and reverse logistics. Further, a majority of the respondents indicated that they would not make additional purchases from an e-tailer if they received items in colors different than they expected. The paper concludes with suggestions for future research.*

Introduction

Estimated global B2C e-commerce sales for 2003 range from 144 to 380 billion US dollars. This estimate, reported by OECD, is based on a variety of sources including Boston Consulting Group, Giga Information Group, Forrester Research, Dataquest, Gartner Group, Warburg Dillon Read, and Pro Active (Organization for Economic Co-operation and Development (OECD), 2001). Further, global B2C e-commerce is forecast to hit US$562 billion by 2006 (Sharrard, 2001). Internet sales of non-travel related products in the USA have reached US$988 million a week, with apparel and home items experiencing a greater increase than other items (Puente, 2002). According to one study, the Internet will influence US$400 billion in US retail sales in 2003 and as much as US$1 trillion by 2006, and the study indicates that half of the online shoppers report that they first researched goods on the Internet and then purchased the items over the telephone (IMRG.org, 2001). Apparel has been one of the top eight industries involved in Internet shopping in the USA (Krantz, 1998). According to a 2002 UCLA study, 48.2 percent of new users (less than one year Internet experience) and 41.8 percent of experienced users (greater than six years of Internet experience) reported making online clothing purchases (Lebo, 2003).

The increasing number of e-commerce transactions involving fashion merchandise requires that detailed product information be provided to potential consumers before they are comfortable with making a purchase. A critical component of that information is the color of the products being considered for purchase. Color information can consist of both verbal information (e.g. a description of a product as being royal blue) and graphical information (e.g. a jpeg or other graphic format showing the product in

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royal blue). This is a significant change from even a few years ago when only color names were available (Puente, 2002). Purchasers can now use the Web to see the entire selection of colors in which a product is available in lieu of having the product or a catalog in front of them. For the purpose of this paper, fashion merchandise is defined as both clothing and accessories for people, and fashion items for the home, such as indoor and outdoor furniture and home decor.

Color representation on e-commerce sites is often inaccurate, and these inaccuracies can lead to several possible outcomes. First, the consumer may not trust the colors that are depicted on his or her monitor and not order the product, leading to a loss of sales from the Web site. Second, the consumer may order the product with the hope that when the actual product is received it matches the color depicted. If it does not, they may return it, again leading to a loss of sales, but with the added costs of reverse logistics and restocking. Third, the consumer may order the product and keep it even though they may not be completely satisfied. In the latter two cases, the unhappy consumer may complain to the company as well as friends about the lack of quality control, which may lead to a loss of future sales not only from the consumer, but also from many of the people who are influenced by this person's opinion. This paper examines the consequences of color inaccuracies and outlines an approach to researching the problem.

It is important to note that consumers who utilize the Internet may proceed in any one of four purchase scenarios. These scenarios are:

(1) Visiting stores to evaluate a product or to gather information prior to purchasing online.

(2) Using the Internet to locate the product and/or a local retailer, and then going to the store to make the purchase.

(3) Using a catalog in conjunction with the Internet Web site for making the purchase decision.

(4) Making both the purchase decision and the actual purchase using only online resources.

According to a UCLA study, 64.7 percent of Internet purchasers surveyed in 2002 follow the first scenario, sometimes or often browsing in traditional retail locations and then buying online, up from 53.2 percent in 2000 (Lebo, 2003). In these cases, the color of the product may be determined prior to ordering, rendering any online color inaccuracy irrelevant. The same UCLA study found that 70.9 percent of Internet purchasers who took part in the 2002 study indicated that they follow the second scenario, and shop online prior to buying in retail stores, a decrease from 75.6 percent in 2000 (Lebo, 2003). These consumers may shop online to find a product or to see if a local store has the product, and then go to the store to purchase it in order to avoid paying shipping and handling or to avoid the delayed gratification associated with shipping delays. In this case, an item's color may be initially selected online but later confirmed or rejected prior to purchase upon examination of the actual item, again minimizing the impact of color inaccuracies. In the third scenario, consumers may refer to a catalog to help with color selection prior to online purchase. Here, the color selection may be influenced more by the catalog than by the Web site representation, since the color of products in catalogs may be perceived to be fairly accurate due to sophisticated color correction techniques available in print media. In the fourth

scenario, the Web site representation provides the sole basis for product selection. This research focuses on the last two scenarios because the e-commerce site provides the primary frame of reference for color selection. In scenario 3, a catalog may be available but the consumer may not have the option of evaluating the color of the item at a retail outlet due to either geographic or transportation limitations. In scenario four, neither a catalog nor a retail outlet is available for color confirmation. In these cases the accuracy or inaccuracy of color representation on e-commerce sites can have wide-ranging implications for both the consumer and the retailer.

Information on color

According to Stone (2001, p. 1), color perception is problematic for a variety of reasons. Color is subjective, that is it's perfectly obvious that color is an intrinsic feature of an object: Grass is green, the sky is blue, the paint on your living room wall is peach, and so on. As obvious as this may be, however, it's not so. Color is actually a sensation, just like touch. And the colors you see are purely subjective, as interpreted by your visual system and your brain.

Lighting affects color of an item including, for example, a printout will vary depending on the light, so it will look different under incandescent light, florescent light, and daylight, for example. Identical colors can also be metameric pairs. For example, two items that are the same color under one light can be different colors under another light.

Colors are affected by adjacent colors. Perception of a color will change, depending on the colors around it, an effect called simultaneous contrast. If a small square of green is placed on a blue background, the green will have a yellowish tinge. Change the background to yellow, and the green will have a blue tinge.

The human eye is different from a scanner or camera. As a result the sensors in scanners and cameras are sensitive to specific frequencies of light in different proportions than the color sensitive cones in the human eye.

Different devices have different color gamuts. Monitors can show colors that printers can't print, and printers can print colors that monitors can't show. Cameras and scanner sensors can register colors that neither monitors nor printers can produce.

Different devices use different color models. A color model is simply a mathematical way to represent colors. When different devices use different color models they have to translate colors from one model to another, which often introduces errors. This is a particular problem for device-dependent models, meaning models defined strictly in terms of a specific printer, monitor, scanner, or camera.

The factors noted above indicate that the adverse effects of inaccurate color representation afflict not only online shopping sites, but also more traditional means of shopping for fashion products, such as retail stores and printed catalogs. The problem is actually more a matter of perception than representation, and this gives rise to the difficulty in accurately portraying the color to the consumer. Color is a sensory perception related to the frequency of the light waves being reflected from the item being viewed and not an intrinsic property of that item. This is why it is entirely possible that two items viewed in a retail store, say under fluorescent lighting, may appear to be the same color yet when viewed outside, under natural sunlight, may appear to be different colors.

Printed catalogs introduce yet another set of lighting factors that impact the consumer's perception of a fashion product's color. An image of the item appearing in the catalog is created under one set of lighting conditions, yet may be viewed under an entirely different set of lighting conditions. Even though the image may be painstakingly color corrected to match the original item, the catalog producer has no control over the lighting conditions under which that image will ultimately be viewed. An additional problem associated with catalogs is that the colors represented in the printing process are a close approximation produced by color composites. Most printers utilize the CMYK color model, which approximates colors in terms of the amounts of each color of ink – cyan, magenta, yellow, and black. The color gamut that a printer is able to represent is much smaller than the entire range of colors that the human eye can perceive, thus the approximation is often lacking in precision.

Images of fashion products presented on the Web are subject to the same lighting issues as catalog images during their creation and viewing, as well as to a host of hardware and software factors. Some of these factors include the graphic file format in which the image is stored, the type, brand, and age of the monitor on which the image is viewed, the graphics card to which the monitor is attached, and operating system settings for number of colors to be displayed and the resolution of the display. Personal computers owned by consumers vary in image presentation due to differences in graphics cards and monitor resolution capabilities (*Imation*, 2001; *Business Wire*, 1999).

Consumer behavior

To properly assess consumer online shopping behavior, the service quality literature was examined to determine what is known about how consumers judge a company's service. Since online shopping is as much about the service rendered as the purchase of a product, this is deemed very important. Berry *et al.* (1990) state that there are five imperatives for improving service quality: tangibles, reliability, responsiveness, assurance and empathy. They also state that knowing what consumers expect must be coupled with meeting the expectations. In a study examining the impact of technology on the quality-value-loyalty chain, Parasuraman and Grewal (2000) state that reliability is the most critical dimension of service quality. The depiction of color on the Web is a reliability issue since color can vary and does not always meet consumers' expectations. Parasuraman *et al.* (1991a) found that when reliability is compromised, customer service perceptions suffer. Generally, the more reliable the service is, the more the customer will trust the service. One study found that there is a difference in the level of trust in the reliability and accuracy of information on the Internet between non-users and users (Lebo, 2003). Non-users were much less trusting than users, with 66.5 percent of non-users saying that only about half or less of the information was reliable and accurate, while 47.2 percent of users were in agreement.

Previous studies reveal a link between service quality and behavioral intentions. There are links between service quality and willingness to recommend a company to others (Boulding *et al.*, 1993; Parasuraman *et al.*, 1988, 1991b), between service quality and repurchase intention (Boulding *et al.*, 1993), between service quality and reduced spending or exit (Richins, 1983; Scaglione, 1988), and between service quality and complaint behavior (Singh, 1988). Zeithaml *et al.* (1996) present a model of these links.

A distinction must be made between choice criteria and satisfaction drivers. consumers may select a product using one set of criteria (choice criteria) and determine if they are satisfied with the product using a different set of criteria (satisfaction drivers) (Oliver, 1997). Choice criteria for fashion items may include both basic product features and augmented product features. The basic product features include, but are not limited to, considerations such as size, fabric, style, and color. These features may also be satisfaction drivers since they will influence post-purchase behavior. For instance, a consumer may select a fashion accessory due to the color, and derive satisfaction since the item completes the stylish look that he/she was striving for in their ensemble. In such a case color is a choice criteria when making the purchase decision, and a satisfaction driver once the item has been received. In another example, a person may desire to purchase a blue suit for work and therefore limit their selection to only suits that are available in a range of blue. Once a suit in an acceptable shade of blue is found, other choice criteria, such as style, fabric and size, take over. When the customer receives the suit, their behavior is then driven by satisfaction drivers. The customer may be satisfied since the suit fits properly, looks stylish, and is of the correct blue color. Or, the customer may be dissatisfied because even though the suit fits correctly and is stylish, the blue is not the same color perceived by the customer on the e-commerce site. Various studies confirm that some features of a transaction drive pre-purchase behavior, while others clearly drive post-purchase behavior, while still others may drive both pre- and post-purchase behavior (Gardial *et al.*, 1994; Voss *et al.*, 1998).

Griffith *et al.* (2001) suggest that e-tailers must be careful with how they approach the online shopping experience, because their research has shown that retailers who use catalogs cannot simply duplicate the catalog online, but rather they must provide a more dynamic look to the Web site. Therefore, when retailers do use the Internet they must know which components can or should be manipulated to achieve the desired goals for the Internet shopping experience. While there have been studies that report on attributes such as ease of ordering, product selection, product information, product representation, prices, navigation, delivery, customer service, privacy policies, and shipping and handling (Reibstein, 2002), a search of the literature found no research specifically on color. Either product representation, which had an importance ranking of 3 on a scale of ten in Reibstein's study, or product information, which had a ranking of 8, might encompass color, but it is unclear into which category consumers would place color. Further, both of these attributes are too broad to isolate the effect of color.

Not all researchers agree that specific attributes that characterize the shopping experience can be examined individually. Elliot and Fowell (2000) suggest that individual components of the online shopping experience, when examined in isolation, do not lead to a complete picture of the experience. Instead, they assert that the total experience must be examined in its entirety before it is possible to gain a complete understanding. Burke (2002) also concentrates on the whole shopping experience. While he found that product information was an important factor for Internet sites to provide for shoppers, individual components that may influence the shopping experience, such as color depiction, are not considered. The only means of depicting the color of the products in the research are thumbnails, which are small product photographs, and/or detailed product photographs.

However, Burke did find that the level of "must have" product information ranged from a high of 78 percent for appliances to a low of 37 percent for books. Burke's research also showed that 8 percent of the respondents preferred to use a variety of channels to investigate new products, and 74 percent use online searches to get product information to make comparisons and evaluate the alternatives. Further, the study showed that consumers prefer using a media that accurately portrays the specific product characteristics under purchase consideration. The Internet rated high for items that were not color sensitive, while catalogs and in-store visits rated high for items such as clothing and furniture, which have an important visual component, as well as for items that were classified as expensive, infrequent purchases such as paint and wallpaper. Consumers indicated that for online purchases of apparel, thumbnails (46 percent) and full-page photographs (41 percent) were important. While this study does not specifically target color considerations, the implications for color include:

- the amount of "must have" product information associated with the online purchase of color-sensitive clothing would be relatively high;
- consumers prefer a media that accurately portrays product characteristics, which is assumed to include color, and therefore are unwilling to rely on the Internet for an accurate depiction of items with a visual component such as color; and
- consumers who shop online consider the visual depiction to be important, and therefore color must be accurately represented.

Research performed by Griffith *et al.* (2001) confirms a need to examine shoppers' interactions with the Internet. Their study focuses on the fashion industry looking at the differences between catalogs and how products are depicted on the Web. The findings support the concept that simple replication of the catalog on the Web is not appropriate, and that the Web version must have enhancements. Here again the study does not consider color as a variable.

Ariely and Carmon (2000) argue that satisfaction with the purchase process outweighs the satisfaction with the product information or even the product itself. This would indicate that Web sites that do a poor job of depicting the color of a product would not be as well regarded as ones that do a good job of depicting color. This also has an effect on return visits to the site; the same way consumers become "regulars" at a traditional store (Alba and Hutchinson, 1987). In fact, Dholakia and Bagozzi (2001) argue that there is a strong similarity between brand loyalty and site loyalty. Reibstein (2002) found that product representation, which may include color, was the third highest factor affecting likelihood to buy again from a particular online merchant. The only two factors rated higher were customer support and on-time delivery.

This study focuses on the choice criteria of color because industry studies have shown that color is a critical factor in the selection of fashion products (*Business Wire*, 1999), and because color is one of a few basic product features that can be visually depicted on a monitor for Internet purchases. It is the only basic product feature that will vary from monitor to monitor, unlike other features, such as style, that will not vary when viewed on different monitors. Industry reports that stress the importance of color, in conjunction with the lack of studies that specifically address color, prompted this research.

Industry research has shown that while color is a critical factor in the selection of fashion products, customers have come to distrust color accuracy on the Web (*Business Wire*, 1999). Although 76 percent of Web users shopping for color related items indicate that color accuracy is an important characteristic, 60 percent of the users do not trust the item color as displayed in the product image (*Business Wire*, 1999). As a consequence of this lack of faith, approximately 30 percent of e-consumers will not purchase color-critical products because they doubt its actual color (*Business Wire*, 1999). This is especially true for those who shop for clothing and accessories, since color is often a critical factor in the selection of such items.

Not only can color inaccuracy discourage purchases, but it may also have post-purchase consequences. When the color of an item that is received does not match what the consumer expects, there is a likelihood that the item will be returned. Bunn (1999) estimates that 40 percent to 50 percent of items ordered over the Internet are returned. He also states these returns are estimated to constitute up to approximately 5 percent of the overall logistics costs within organizations, costs eventually passed on to consumers. According to one industry survey, 15 percent of color-critical items are returned (*Business Wire*, 1999). In addition, many consumers are dissatisfied but do not return the item for various reasons. According to industry surveys, between 66 percent (*Imation*, 2001) and 85 percent (*Business Wire*, 1999) of consumers who received products with an unsatisfactory color did not return the products in spite of their dissatisfaction. Quick (2000) reports that concerns over the ease of returning merchandise are among the main reasons for not shopping online.

In addition, dissatisfied customers may simply stop shopping rather than complain or return color-inappropriate fashion items. In fact, one study found that 95 percent of dissatisfied customers don't complain but simply stop buying from the merchant (US Office of Consumer Affairs, 1986). Industry studies show that over 50 percent of online shoppers would not make future purchases from an online merchant that delivered an item in a color that was not what they expected (*Imation*, 2001). This is especially significant since Reichheld (1996) reports that a 5 percent reduction in the customer defection rate can increase profits by 25 percent to 85 percent, depending on the industry.

In order to retain customers, merchants must keep those customers highly satisfied. When customers are satisfied, they stay loyal longer, buy more, talk favorably about the company and its products, and cost less to service because the transactions become more routine (Kotler, 2000). Keeping customers satisfied is cost effective, since acquiring new customers can cost five times more than the costs involved in satisfying and retaining current customers (Reichheld, 1996). Kotler (2000) notes that it costs more money to lure a customer away from the competition than to keep one. Without the ability to retain customers, Web marketing will fail (Reichheld and Schefter, 2000).

In summary, these academic and industry studies indicate that a substantial color inaccuracy problem does exist and does impact online purchasing behavior. When online customers are conditioned to distrust what they see on e-commerce sites, they may make complaints about unsatisfactory items, return those items, or even stop making online purchases altogether. The full effect of this problem needs to be investigated further and the nature of the problem validated. This study is an initial investigation into the pre- and post-sale ramifications of inaccurate color representation on the Internet. Due to the complexity of the color depiction problem,

many approaches must be utilized to understand the full extent of the problem. This study focuses on a specific aspect of the problem.

Research questions

The research question that prompted this study inquires if the inaccuracy and inconsistency of color representation using computer display equipment negatively influences a consumer's satisfaction with the online purchase of fashion-related items. This question is far too broad to be accurately accessed as stated. Therefore, the question is broken down into six much more specific questions addressing various parts of the online purchase decision. Not all aspects of the purchase decision are covered due to the researchers' desire to concentrate on the effects of color on the decision.

The distinction between choice criteria and satisfaction drivers (Oliver, 1997) and the research by Gardial *et al.* (1994) and Voss *et al.* (1998) laid the foundation for the first research question: "Does the inaccuracy and inconsistency of color representation using computer display equipment negatively influence a consumer's choice criteria with the online purchase of fashion-related items?" This question is warranted due to industry research reported in *Business Wire* (1999), and the lack of specific research on color as either a choice criteria or satisfaction driver or as a tangible part of the purchase process (Berry *et al.*, 1990).

The second research question comes from research by Berry *et al.* (1990) on reliability and empathy, and the industry research reported by *Business Wire* (1999). These studies deal with various forms of trust and therefore the research question is "Does the inaccuracy and inconsistency of color representation using computer display equipment negatively influence a consumer's trust in purchasing fashion-related items online?"

The third research question is "Does the inaccuracy and inconsistency of color representation using computer display equipment negatively influence a consumer's willingness to purchase fashion-related items online?" This question is also based on Berry *et al.*'s (1990) research on reliability, which indicates that if a product representation can be relied upon, consumers are more willing to make a purchase, as well as research by Boulding *et al.* (1993), Richins (1983), Scaglione (1988), Elliot and Fowell (2000), Griffith *et al.* (2001) and Zeithaml *et al.* (1996) and the industry research reported in *Business Wire* (1999).

Research into complaint behavior by Singh (1988) and Zeithaml *et al.* (1996) formed the foundation for the fourth research question. "Does the inaccuracy and inconsistency of color representation using computer display equipment increase the likelihood that a consumer will complain to an online supplier of fashion-related items after having received a product in an unexpected color?"

The fifth research question, "Does the inaccuracy and inconsistency of color representation using computer display equipment increase the likelihood that a consumer will return an online purchase of fashion-related items?" is based on the findings of Bunn (1999) with regard to reverse logistics and the return figures reported in *Business Wire* (1999).

The sixth research question is stated as "Does the inaccuracy and inconsistency of color representation using computer display equipment negatively influence a consumer's intention to purchase fashion-related items online?" Research by Boulding

et al. (1993) on willingness to purchase and supported by industry research from *Imation* (2001) and *Business Wire* (1999) formed the foundation for this question.

As the study unfolded, an additional research question regarding the color depiction of fabric items on the Web became evident. The main point was to determine if there are any differences based on demographics. The research question therefore is "Does the perception of inaccuracy and inconsistency of color representation using computer display equipment vary by demographics with regard to the purchase of fashion-related items?"

Research methodology

This investigation involved a survey structured to investigate consumer behavior with respect to e-commerce, and was conducted as one facet of a larger project designed to collect data about respondents' assessments of color accuracy on the Web.

The data collection process involved several steps. First, a series of e-mail messages and telephone interviews were utilized to establish if industry leaders agree that the problem of accurate color representation on the Web actually exists. The information gathered in this phase of the study confirmed that a problem exists and that only some Internet marketers are aware of it. In addition, industry feedback provided a partial basis for the questionnaire used in this research project.

The next step in the data collection process involved the design of the questionnaire. The questionnaire was structured to provide information about each of the research questions discussed above, and includes questions regarding purchase behavior, purchase intention, complaint behavior and product return behavior.

To assess purchase behavior, the questionnaire inquires if respondents have ever purchased products via the Web, and how many purchases were made in the preceding year. Another question inquires if respondents keep the printed catalog in hand when shopping on e-commerce sites. This question was included to verify assumptions made by some leading Internet marketers that consumers always refer to a catalog when shopping on the Web.

In order to assess purchase intention, respondents were asked to indicate which type of products they would be willing to purchase online. Since color is the thrust of this research project, another question requests that respondents indicate which products they would not be willing to purchase online if the actual color of the product were in doubt.

Another item on the questionnaire asks which items the respondent would return if the color of the actual product differed from its representation on the Internet. Two associated questions were included to provide insights into return behavior. The first asks if respondents have ever actually returned a product because of improper color. The second attempts to assess if they complain about color discrepancies to the merchant. In order to assess customer retention issues, the questionnaire asks if respondents would continue to make purchases from an online merchant that delivered an item in a color that was different than expected.

Other questions were included to gather information about consumer trust as well as preferences for color accurate Web sites. Standard demographic questions were included in the questionnaire for classification purposes.

Sample

The questionnaire was administered to university students because of the availability of a large number of subjects who represent a cross-section of both experienced and inexperienced Internet shoppers. It is critical to involve experienced users since their familiarity provides them with a more realistic perspective of Internet shopping than inexperienced users. Other research dealing with Fashion Marketing on the Web has used a similar sample (Griffith *et al.*, 2001). Three hundred questionnaires were collected from the students who participated in this study.

The respondents are mostly college students who are attending full time (91 percent), and 65.9 percent were between the ages of 21 and 26. The gender distribution was 63.5 percent male and 36.5 percent female. Other demographic breakdowns include 52.5 percent single and 47.5 percent married students, and 67.8 percent have no children at home. Income level was on the lower end, which was expected due to the age distribution and the fact that most are full-time students. The student population was deemed acceptable since the demographics of the school are not traditional, with an older than normal student body. In addition, almost half of the subjects (47.5 percent) are married, and about a third (32.2 percent) have children. Thus, the sample does not suffer from homogeneity to the degree that many student samples. Because many of the subjects are not "typical" college students, they reported previous experience purchase of items such as home accessories and furniture.

Data analysis and findings

Frequency analysis and crosstabs were the primary tools used to analyze the results of the survey. Frequency analysis is used to determine if the data is entered in a manner that is consistent with the layout of the questionnaire. Since the range of possible answers is known, any responses outside the known and fixed range is a good indication of data entry problems. Sometimes the error is obvious and can be corrected; while other times the data point must be recoded to indicate missing data. Another more important use of frequency analysis is to determine the general description of the sample of respondents. This simple analysis will reveal whether or not the sample matches the population of Internet shoppers. Crosstabs were used to find if there were significant differences between groups.

Overall, 14.8 percent of respondents indicated that they have had personal experience with inaccurate color online. Some 78.3 percent of our respondents have purchased online within the year preceding the research point. For those who purchased online, the number of purchases ranged from 1 to 60 with the median number of purchases being four. Most of the respondents (61 percent) indicated that they made between one and eight purchases, while 19 percent of the respondents indicated that they made ten or more purchases during the last year. Table I shows the purchase frequency distribution. Since the thrust of this research was the perception of color on the Web and not the impact of color on purchase, respondents were not queried on the specific nature of their purchases, but rather on product categories (Table II).

To confirm what the research team learned from online merchants about online shopping behavior, respondents were asked if they use merchants' catalogs while ordering online. We found that only 6.0 percent of those who have purchased always use a catalog when ordering, 53.4 percent sometimes use a catalog when ordering online, and 40.6 percent do not use a catalog. Table III shows the results.

			Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	0		57	19.0	19.8	19.8
	1		38	12.7	13.2	33.0
	2		43	14.3	14.9	47.9
	3		26	8.7	9.0	56.9
	4		24	8.0	8.3	65.3
	5		26	8.7	9.0	74.3
	6		6	2.0	2.1	76.4
	7		9	3.0	3.1	79.5
	8		3	1.0	1.0	80.6
	10		24	8.0	8.3	88.9
	12		4	1.3	1.4	90.3
	15		7	2.3	2.4	92.7
	16		1	0.3	0.3	93.1
	20		9	3.0	3.1	96.2
	25		3	1.0	1.0	97.2
	29		1	0.3	0.3	97.6
	30		3	1.0	1.0	98.6
	40		1	0.3	0.3	99.0
	50		2	0.7	0.7	99.7
	60		1	0.3	0.3	100.0
	Total		288	96.0	100.0	
Missing	System		12	4.0		
Total			300	100.0		

Table I.
How many purchases?

Items purchased	Number of respondents[a]	Percentage of respondents
Clothing	136	58.9
Fashion accessories	82	35.5
Home accessories	69	29.9
Indoor furniture	20	8.7
Outdoor furniture	37	16.0

Table II.
Product category purchases

Note: [a] Number of respondents reporting a purchase greater than total ($n = 231$) since many made purchases in more than one category

Among those who have purchased in the last year, 12.1 percent have complained to the online merchants if an item delivered did not adequately match the online image (Table IV), and 10.9 percent have returned an item that was delivered in a color different from what was expected (Table V). Over a third (67.9 percent) of those who complained also returned the item in question (Table VI). Of those who complained, only 41.9 percent indicated that they would continue to purchase from a merchant even if they had a color problem (Table VII).

To investigate purchase intention, respondents were asked if they have decided not to purchase an item if the color was in doubt. Table VIII shows that 33.9 percent indicated that they have not purchased an item when color was in doubt. Further, 62.3 percent, those who indicated a response of 5 or above on a 7 point scale where 7 is always, indicated that they would complain if an item were delivered in a color that

was not expected (Table IX). Also, 60.1 percent indicated that they would return a product if the item received differed in color from what was expected (Table X).

Examination of the research questions

Each of the research questions is examined using the basic descriptive statistics. The results for each question are discussed individually, with additional discussion presented in the Conclusion section that follows.

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Always	17	5.7	6.0	6.0
	Sometimes	151	50.3	53.4	59.4
	Never	115	38.3	40.6	100.0
	Total	283	94.3	100.0	
Missing	System	17	5.7		
Total		300	100.0		

Table III. Use catalog when ordering online

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Yes	28	12.1	12.1	12.1
	No	203	87.9	87.9	100.0
	Total	231	100.0	100.0	

Table IV. Complained to online merchant

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Yes	25	10.8	10.9	10.9
	No	205	88.7	89.1	100.0
	Total	230	99.6	100.0	
Missing	System	1	0.4		
Total		231	100.0		

Table V. Returned items

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Yes	19	67.9	67.9	67.9
	No	9	32.1	32.1	100.0
	Total	28	100.0	100.0	

Table VI. Those who have complained and returned

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Yes	13	41.9	41.9	41.9
	No	18	58.1	58.1	100.0
	Total	31	100.0	100.0	

Table VII. Those who complained and continued to purchase

The first research question was "Does the inaccuracy and inconsistency of color representation using computer display equipment negatively influence a consumer's choice criteria with the online purchase of fashion-related items?" To assess the level of consumer satisfaction with online choice criteria of fashion-related items, consumers were asked both what fashion-related items would they purchase online and if they would continue to make purchases from an online merchant that delivered an item in a color that was different than expected. Our findings indicate that 58.9 percent would purchase clothing, 35.5 percent would purchase clothing accessories, 16 percent would purchase outdoor furniture, 8.7 percent would purchase indoor furniture, and 29.9 percent would purchase home decorations. It is important to note that 58.1 percent indicated that they would not make a repeat purchase.

The second research question was "Does the inaccuracy and inconsistency of color representation using computer display equipment negatively influence a consumer's trust in purchasing fashion-related items online?" Respondents were asked to indicate their level of trust of the color of products depicted on computer monitors. The average level of trust was 4.4 on a 1 (low) to 7 (high) scale. A total of 21 percent indicated a trust level of 6 while 44.2 percent rated their trust at the mid-point (4) or lower. No difference was found between those who have had a personal experience with poor color

Table VIII.
Decided not to purchase due to color

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Yes	79	33.6	33.9	33.9
	No	154	65.5	66.1	100.0
	Total	233	99.1	100.0	
Missing	System	2	0.9		
Total		235	100.0		

Table IX.
Likelihood of complaining

Valid		Frequency	Percentage	Valid percentage	Cumulative percentage
Never	2	9	3.9	3.9	3.9
	3	34	14.7	14.7	18.6
	4	44	19.0	19.0	37.7
	5	58	25.1	25.1	62.8
	6	59	25.5	25.5	88.3
Always	7	27	11.7	11.7	100.0
	Total	231	100.0	100.0	

Table X.
Likelihood of returning

Valid		Frequency	Percentage	Valid percentage	Cumulative percentage
Never	2	19	8.2	8.2	8.2
	3	30	13.0	13.0	21.2
	4	43	18.6	18.6	39.8
	5	62	26.8	26.8	66.7
	6	56	24.2	24.2	90.9
Always	7	21	9.1	9.1	100.0
	Total	231	100.0	100.0	

representation and those who have not. A significant correlation between trust and willingness to purchase was found (Mann-Whitney $U = 0.31$, $Z = 1.875$).

Considering the level of trust in the color depicted on a monitor, the third research question was stated as "Does the inaccuracy and inconsistency of color representation using computer display equipment negatively influence a consumer's willingness to purchase fashion-related items online?" Respondents indicated that fashion items are the ones whose color was least trusted. Most (65 percent) would not purchase clothing if the color was in doubt and 41 percent would not purchase clothing accessories if the color were in doubt. Furniture did not fare well either with 21 percent indicating they would not purchase outdoor furniture, and 50 percent would not purchase indoor furniture if the color were in doubt. A total of 53 percent would not purchase home decorations when the color questioned.

Considering the respondents' attitudes toward trusting color on a computer monitor, it is not surprising that 87 percent of the respondents would return clothing due to color inaccuracies while 62.5 percent of the respondents would return clothing accessories due to color inaccuracies. For home furnishings, 23 percent of respondents would return outdoor furniture, 53.5 percent would return indoor furniture, and 59 percent would return home decorations.

Respondents who made an online purchase in the last year were asked to indicate if they have complained to online merchants by responding to the question "Does the inaccuracy and inconsistency of color representation using computer display equipment increase the likelihood that a consumer will complain to an online supplier of fashion-related items?" Our findings indicate that 12.1 percent of purchasers have complained to the online merchants if an item was delivered in a color that was not expected.

Respondents who made an online purchase in the last year were also asked if they had returned an item to the merchant by responding to the question "Does the inaccuracy and inconsistency of color representation using computer display equipment increase the likelihood that a consumer will return an online purchase of fashion-related items?" Our findings indicate that 10.9 percent have returned an item that was delivered in a color different from what was expected. Interestingly 67.9 percent of those that complained also returned the item.

We asked respondents what items they would purchase online to measure purchase intention of fashion-related items. The question was stated as "Does the inaccuracy and inconsistency of color representation using computer display equipment negatively influence a consumer's intention to purchase fashion-related items online?" Many of the respondents (58.9 percent) indicated that they would purchase clothing of any kind, while 35.5 percent indicated that they would purchase clothing accessories. For home furnishings, 16 percent would purchase outdoor furniture, 8.7 percent would purchase indoor furniture and 29.9 percent would purchase home decorations such as wall hangings.

The final research question was "Does the perception of inaccuracy and inconsistency of color representation using computer display equipment vary by demographics with regard to the purchase of fashion-related items?" We found no significant differences with regard to gender, age or income for any of the research questions investigated.

Conclusion and discussion

Internet marketers of fashion items must be more aware of the consequences of color inaccuracies on an e-commerce site. Conversations with Internet marketers during the initial stages of this undertaking revealed that many think a vast majority of consumers are not concerned with color accuracy when considering making purchases from an e-commerce site. These e-tailers indicated that they assume that their customers normally refer to catalogs when they shop online. Although this may have been a valid assumption in the early days of Internet fashion marketing, this study found that it is no longer the case, with only 6.0 percent of the respondents indicating that they always use a catalog in conjunction with the computer monitor when ordering, as opposed to 40.6 percent who never use a catalog when shopping online. This would support research by Griffith *et al.* (2001) and Elliot and Fowell (2000) in that marketers must design their Web sites to appeal to users and not rely on other forms of product representation, since users are moving away from using catalogs in conjunction with the Internet.

Shoppers must trust that the product they order will be what they receive. However, in this study the average level of trust was only 4.4 on a one-to-seven scale, indicating only moderate trust in color accuracy. In fact, 44.2 percent reported a level of trust below the mid-point of 4, while only 21 percent reported a trust level of 6 or higher. When asked about purchase intention, 29 percent of the respondents indicated that they would not purchase the item of interest if the color were in doubt. This supports the concept that reliability is the most critical dimension to service quality as proposed by Berry *et al.* (1990) and Parasuraman and Grewal (2000).

This study provides support for previous research on Internet shopping behavior and on pre- and post-purchase behavior. This study indicates that companies are losing potential customers and sales as a result of having colors on the Web that do not accurately represent the true colors of the products being sold. This conclusion is based on the level of customer dissatisfaction, trust, rate of complaint behavior (12.1 percent) and return behavior (10.9 percent). Also, with 58.1 percent of respondents indicating that they would not make a repeat purchase from a company that shipped a fashion item that was in a color that was different from what was ordered and expected, it is fair to state that this is a strong level of dissatisfaction and a strong indication that customer retention could be negatively impacted.

Increased dissatisfaction on the part of consumers leads to greater costs in both customer service and reverse logistics. For those respondents who made an online purchase in the last year, 12.1 percent have complained to the online merchants if they received an unsatisfactory color. Further, 10.9 percent of those same respondents have returned an item that was delivered in a color different from what was expected. Over sixty-seven percent of those who complained also returned the item in question. This is another indication that companies will incur additional costs if the colors of items on the Web are not accurately represented. This clearly supports the research presented by *Imation* (2001) and *Business Wire* (1999) as well as complaint behavior research by Singh (1988) and return behavior research by Bunn (1999).

Another area of grave concern is customer retention. Many respondents indicated that they neither complain nor return unsatisfactory items, but simply keep the product and refrain from making future purchases from that Web site which again supports *Imation* (2001) and *Business Wire* (1999). Over 58 percent of the respondents

who had previously made purchases indicated that they would not make future purchases if a fashion item were delivered in a color that was different from what was expected. This finding lends support to the research of Boulding *et al.* (1993), Richins (1983) and Scaglione (1988). As discussed earlier, the impact of poor customer retention can be substantial, so much so that the issue must be addressed.

This research will lead to better management of e-commerce through better understanding of the benefits and drawbacks of presenting goods via computer display. This research spotlights the necessity of collaboration between departments within organizations such as information systems, marketing, and operations. This will allow organizations to work more efficiently, leading to improved customer satisfaction and ultimately allowing e-commerce to be more competitive. E-tailers who can offer better color representation on their Web portal can gain a competitive advantage since they will offer a better value to online shoppers.

Future research

This study reveals a need for future research in multiple directions. With respect to technology, there are several avenues that need exploration. One avenue would be to determine the causes of color inaccuracy when images are viewed, as well as when those images are captured. Another avenue would be to investigate the impact of computer monitors, video cards, image file types, and other technical factors that may influence the delivery and display of color on the Internet.

Another interesting avenue of research would be to compare actual color swatches to video images of those color swatches to determine the level of perceived difference in the two samples and to explore means of capturing more accurate color when creating e-commerce sites.

With respect to marketing, at least five avenues that need exploration are available. First is the need to determine the significance of color accuracy on overall purchase and post-purchase satisfaction. A second avenue involves further examination of consumer complaint behavior in terms of personal values and propensity to complain. The third is to determine the extent to which color inaccuracy contributes to reverse logistics costs.

The investigation of purchasing behavior in a multi-channel environment, especially in cases where a catalog is used in conjunction with the Internet Web site for making the purchase decision is the fourth avenue. The fifth and last avenue is to determine the extent of the correlation between risk aversion and a customer's unwillingness to purchase color-critical products from an e-commerce site if color accuracy is in question.

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