A System for Communicating Color: What Do Consumers Think?

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Abstract

Light source color is poorly understood by consumers. Is this because consumers simply don't care about color, or is it because color has not been adequately promoted as a feature of light sources? Six focus groups were held in three cities in the United States: Sacramento, Columbus, and Atlanta. Consumer attitudes and awareness about color and purchasing lamps for their homes were documented and analyzed. Variations of a proposed color communication system were presented to the focus groups to assess consumer interest, comprehension, and suggested modes of educating consumers. Results indicated that color is not a primary driver in current purchasing behavior, but that it could be. The focus groups were remarkably alike across gender and locations as to their opinions on color, although the focus groups in Sacramento were much more sensitive and knowledgeable about lighting energy efficiency issues than those in Columbus or Atlanta. Once actual color differences among light sources were seen by the focus groups, there was consensus that a color communications system would be desirable and probably yield better opportunities for improved home lighting. Incorporating the results of the focus group with the foundations for color science,[1] a revised color communication system is proposed.

Introduction

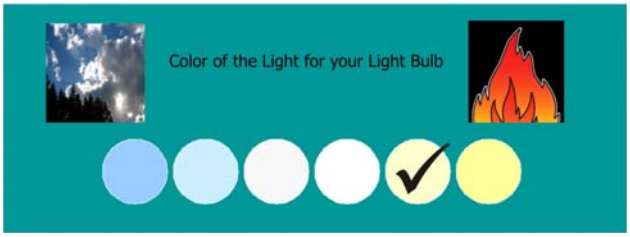
For the past century, the predominant light source for homes has been the incandescent lamp. Most incandescent lamps have similar correlated color temperatures (CCTs), 2700-3000 K. Before 1990, the occasional foray into higher CCT light sources was limited to fluorescent lamp purchases for utility spaces such as basements, workshops, and laundry rooms. Lamps of different CCTs were not usually seen side by side, and there was little reason for consumers to think about light source color when they purchased lamps for their homes.[a]

In the past decade, there has been a growing penetration of fluorescent lamps into homes. Fourteen percent of the lamps now used in residences are estimated to be fluorescent, affording a dramatic increase in light source color options.[2] The introduction of solid state lighting products for the home also promises to diversify light source color choices. Further, manufacturers are marketing special lamps with a wide and probably confusing array of descriptors such as warm, soft, full-spectrum, and natural.

Inconsistent color appearance is often cited as a barrier to consumers' acceptance of compact fluorescent lamps (CFLs). There have been anecdotal reports of complaints that consumers have lodged with government and utility program managers about the color consistency of CFLs being promoted for energy efficiency.

Rea and Deng [1] developed an initial proposal for a color communication system for CFL packages, shown in Figure 1. They proposed a system that should be easy for consumers to understand while at the same time was consistent with existing color communication conventions. They explain:

"…the color of each disc roughly corresponds to the color appearance of radiant flux emitted by the lamps in that family. …Two icons, daylight and fire, are presented as anchors to the two ends of the range of colors available for that family of lamps. To be consistent with the current method of communicating color with a CCT designation, the following constraints were placed on the proposed system. First, the order of the discs, blue-white on the left and yellow-white on the right, is consistent with the order of colors along the black body in the CIE colorimetric systems (1931 as well as 1976). Second, discs, rather than some other geometric form, were chosen because they resemble the nearly circular MacAdam ellipses in the CIE 1976 system of colorimetry that are used as the "hidden" criterion for color consistency in lamp CCT designation. Third, six discs, rather than some other number, were chosen because there are six CCTs currently recognized by the industry for fluorescent lamps."



[a] Light source color in this paper refers to the color appearance of the radiant flux coming from a lamp, commonly referred to as CCT by the lighting industry.

Figure 1: The initial proposed color communication labeling system (ref)

In August, 2005, focus groups were conducted to assess current consumer understanding and interest in light source color. The focus groups also evaluated the effectiveness of variations to Figure 1 to communicate light source color to consumers. A light source color communication system is proposed here, based on the results of the focus groups and an interest by industry to bridge existing industry metrics with wide commercial appeal.

Method

A color communication advisory group was formed to consider the proposal by Rea and Deng, comprised of representatives from lamp manufacturers, government agencies, and an organization for energy efficiency program collaboration. The primary goal for the group was to assess a color communication system that could assist consumers in the selection of CFL products. The group was also interested in applying this system to the purchase of other light sources, including light emitting diodes (LEDs). The advisory group invited proposals from four market research firms with experience in consumer related lighting issues. Critical Insights of Portland, Maine was selected. Under direction of the advisory group, Critical Insights developed a discussion guide, a screening guide for participants, and conducted all focus group discussions.

Six focus groups were held in three cities: Sacramento, Columbus, and Atlanta. Each location had two focus groups, one all male and one all female. Every focus group lasted about 90 minutes, was led by a professional facilitator, and was observed through a one way mirror by one or more members of the advisory group.

There were a total of 66 participants selected through a telephone screening process. They were provided food and paid $75 each for their time. The participants were:

- 25-60 years old
- Homeowners
- Responsible for lighting decisions in their homes
- Comprised of 50% who have purchased a CFL for their homes
- Not a recent focus group participant
- Not employed in market research, advertising, interior design, or lighting

Each focus group followed roughly the same format:

- A warm-up section designed to orient the participants and make them comfortable
- A general discussion about “light bulbs,” gauging the participants’ awareness of lamp properties and their primary considerations and behavior during their lamp purchases
- An assessment of their current comprehension of light bulb packages and terminology
- A discussion of their awareness and comprehension of color as related to light bulbs
- An evaluation of comprehensibility and usefulness of a color communication labeling concept derived from Figure 1
- A discussion of the impact that a color communication system would have on their purchasing behavior

In addition, at an appropriate point in the discussion of color, the facilitator turned on four identical table lamps with white shades. Three had 27 W CFLs of different CCTs (5000 K, 3500 K, 2700 K) and one had a 100 W incandescent A-lamp. The table lamps, positioned in a row against a neutral, off-white wall, demonstrated a range of light source colors.

The discussions were recorded. After the focus groups, the facilitator analyzed and presented the results to the advisory group with the following caution, "…focus groups are powerful indices of consumer sentiment, the results of these qualitative inquiries do not have statistical significance. The results should be viewed as leading to directional rather than statistically valid conclusions and meant only to aid in strategic marketing guidance."[3]

The advisory group, considering practical issues regarding labeling systems, color science conventions, and the focus group analysis, modified the proposed color communication system and made recommendations for a comprehensive color communication system.

Results

The six focus groups provided remarkably consistent feedback regardless of gender and the location the group. Most knew little about the differences among light source technologies, often confusing linear fluorescent, CFL, halogen, and LED sources. They also saw little reason to know the differences. Only the Sacramento participants showed a strong awareness of energy efficiency properties and life expectancies of light sources.

Overall, consumers had limited awareness or interest in parameters distinguishing one light source choice from another. Consumers used wattage as the most important parameter in selecting their light sources. For most, wattage or "equivalent wattage" was a surrogate for how "bright" the light source would be. Participants were interested in lamp life in order to minimize the frequency of their purchases, but some questioned the accuracy of the life claims on the packages. Price was also an important consideration, but most had only a sketchy idea of how much different light sources cost and no one knew how much they spend annually on light bulb purchases. These consumers were concerned that the light sources they purchase will fit in their fixture. When purchasing a replacement CFL or reflector lamp, they typically took the old bulb with them to assure an acceptable fit. Color was not cited as an important consideration in purchasing light sources. Verbatim comments included:

> *"The only numbers that I look at is the wattage."*
>
> *"I don't think I've ever looked at anything beyond the wattage."*
>
> *"I'm primarily shopping for price. It doesn't matter to me if it's a clear or frosted light bulb—whatever. It depends on the price."*
>
> *"I only think about the color of light bulbs at Christmas time."*
>
> *"I never noticed a difference in the color of the light bulbs, when it's not lit. I don't know what you would go by to know what you're buying in terms of color."*

About two thirds of the participants purchased their light sources at DIY (do it yourself) stores in bulk. The remainder favored grocery or club type warehouse stores. Most did not save the light source package after installation. There was strong agreement that

purchasing light sources is a confusing and frustrating experience due to the number of choices. They were confused about the quantitative descriptors (e.g., lumens and life) as well as the qualitative descriptors (e.g., daylight, natural, soft). No one read the fine print on the packages.

The participants were initially indifferent to distinctions about color and most did not want to think about yet another thing when purchasing light bulbs. Only a few participants expressed an awareness of color being an option for light bulbs. Those that did either referred to a “warm-cool” dichotomy or considered color to mean “party bulbs.” Some volunteered “full spectrum” lighting as a color issue, but were unsure of what it meant.

The most surprising result was the remarkable transformation that took place once the participants saw the side-by-side table lamps lit with lamps of different CCTs. Before the demonstration, there was little interest in color and no expression of a need to communicate color differences. But immediately after the demonstration, all focus groups expressed amazement at the variations and that they had not noticed such differences before. Some participants expressed concern that they unknowingly may have been choosing their light sources incorrectly. The demonstration immediately created interest in a color communication system and how color differences might be best used to improve their homes’ décor.

Having seen the demonstration of color differences, the participants reacted to variations on a potential color communication system. They felt strongly that:

- All manufacturers should use the same system and that light sources labeled as similar must be similar from product to product and from manufacturer to manufacturer.
- The differentiating label should be on the package, but must also be on the bulb itself because they usually do not keep the package and would look to match the old bulb when purchasing a new one.
- There should be advice as to where and how different light source colors should be used in the home.
- A point of purchase display or demonstration showing the difference in light source colors is important to educate consumers. Printed color circles or squares on the package are not sufficient without a demonstration.

Participants discussed variations on potential communications systems shown in Figure 2.

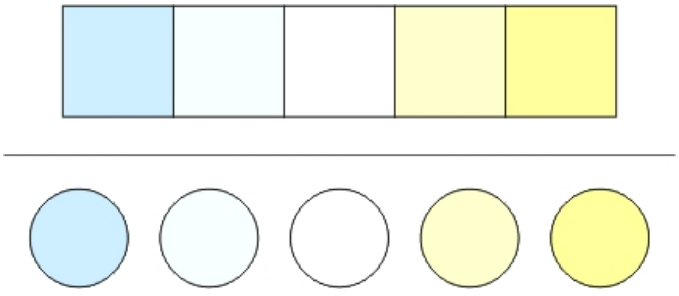


Figure 2: Color communication system shape: Do consumers prefer circles or squares?

A system with either shape was acceptable to the participants, but they preferred the squares. Further discussion revealed that the preference for the squares was related to the proximity of each color segment so that the observer could understand that the colors were along a continuum and the side by side presentation facilitated comparison of the choices.

Participants were shown examples of the color communication system with four and six circles as shown in Figure 3 to stimulate discussion on how many distinct color choices should be offered.

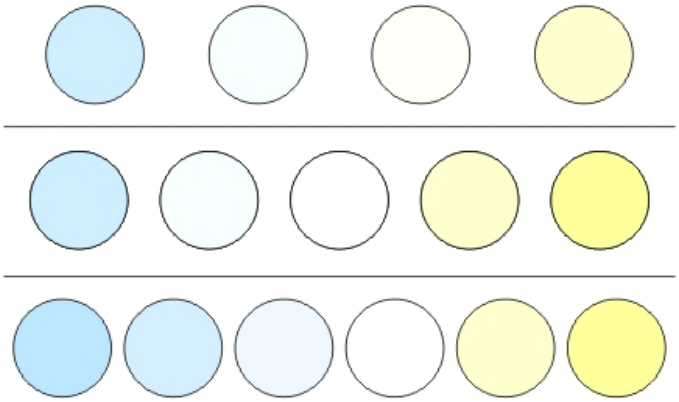


Figure 3: Color communication system:
How many color choices should be offered?

Most thought that five circles representing five choices were sufficient. There was a concern that too many choices would make selecting light bulbs even more difficult than it is now.

There was consensus that the color communication system should be as simple as possible. Therefore, they saw little reasons to add clarifying information or icons. Figure 4 shows options presented to the focus groups.

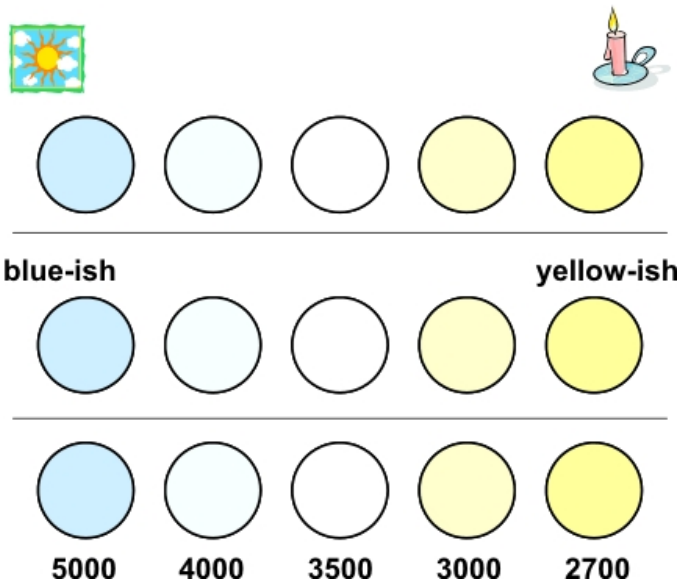


Figure 4: Color communication group descriptors:
Do consumers want icons, words, or numbers to clarify the meanings of the circles?

The sky icon, as a symbol for cool colors and the candle icon, as a symbol for warm color, were seen as confusing and could be misconstrued to indicate lamp brightness; daylight is bright, candle light is dim. The “blue-ish” and “yellow-ish” descriptors were seen as obvious and therefore redundant. The participants strongly disliked the numeric ranges indicating CCT, stating they were meaningless to most and yet another set of numbers to remember.

The focus groups discussed ways to indicate what bulb was in the packaged labeled by with the draft communication color system. The participants thought it was important to have a clear indicator to guide what bulb was in the labeled package.

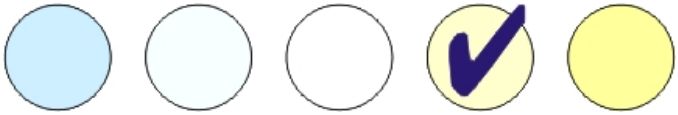


Figure 5: Color communication system:
How do consumers want the color choices indicated or labeled?

The check mark in Figure 5 was considered acceptable. The letter X should *not* be used because they thought it might indicate “not” that color. The participants suggested assigning a letter to each square or circle. They saw this as an easy way to remember the lamp color. They drew the analogy to household batteries that are identified by letters (e.g., Type AAA, C, D).

During the discussions about the likely impact of a color communication system on their purchasing behavior, a surprising two-thirds of the participants indicated that now that they know there are color choices, they would purchase additional bulbs. They felt that there should not be an increase in cost of the bulbs given a color communication system, but that there probably would be.

This sample of verbatim responses captures their views of the utility of a color communications system (after they saw the demonstration):

> *“If I was doing a new room, with a new color, then I would see which bulb could fit the new color and make sure to always buy that same bulb.”*
>
> *“People think of fluorescent lighting as ‘harshness’ and if you had this type of display, it would show people that fluorescent lighting can come in different (less harsh) colors.”*
> *“I think I would be buying more light bulbs if I had more knowledge of how it could look good in my house. I would be doing more things with the lights.”*
>
> *“I would pay more attention if I saw the display and would consider more purchases.”*
>
> *“I would buy more light bulbs because I would want to experiment with different moods in the different rooms.”*
>
> *“I usually just buy standard light bulbs—25, 50, or 75 watt—now I would buy more with the colors.”*
>
> *“In my bedroom, the lights are yellow. This type of display would allow me to use something more relaxing and easier on the eyes, to calm down when work is over.”*
>
> *“I already know that what I’m buying works for me. I don’t want to deviate from something I am already happy with and adjusted to.”*

"I wouldn't buy more light bulbs because I still have X amount of lights. But I would buy differently- like more reds and blues."

After hearing the focus group report and analysis, the advisory group met and reached consensus on recommendations relevant to the development of a revised color communication system proposal.

The advisory group deemed the recommendation to use circles to "resemble the circular MacAdam ellipses in the CIE 1976 system of colorimetry" [1] as elegant intellectually, but beyond the interest of the consumer. Given the focus group participants' slight preference for squares compared to circles and their interest in the close proximity of the color options, coupled with the manufacturers' interest in minimizing the area required on the package, squares were chosen.

Six color choices were chosen since it was close to the number recommended by the focus groups and it accommodates the new requirements for the ENERGY STAR® Residential Fixture Specification (Version 4.0) and the first draft of the version 4.0 of the ENERGY STAR Compact Fluorescent Lamp Specification. Both these specifications require manufacturers to identify one of six correlated color temperatures to market their product: 2700 K, 3000 K, 3500 K, 4100 K, 5000 K, or 6500 K. These could be the basis for the six squares on the color communication system.

The advisory group recommended that a letter ranging from A through F be printed in small font in each the squares as in Figure 6a. The letter A should indicate the coolest square and F the warmest. The coolest square should be on the left progressing to the warmest square on the right, consistent with the order depicted on the CIE color diagrams.[1] There would be a large letter in the square depicting the color of the lamp within the package. Until the communication system becomes commonly understood, it is recommended that the word "color" be printed above the designated square as shown in Figures 6a and 6b.

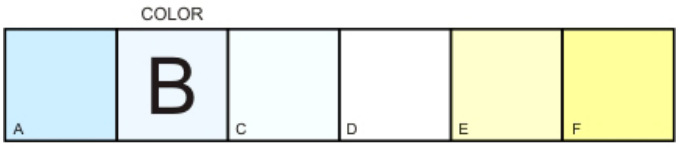


Figure 6a: Color communication system recommendation for package.

Figure 6b: Color communication system recommendation on lamp.

The advisory group agreed with the focus group participants that there should be a three part color communication system: for the package, for the lamp, and for educating the consumer.

Discussion and Recommendation

Initially, members of the focus groups clearly cared little about light source color. Even in the California focus groups which had the most sophisticated understanding and awareness of energy and CFLs, color awareness was very low. There was confusion between color and brightness for all participants. But in all cases, once the participants saw the color differences, they had a mild epiphany. They were interested in being able to exploit opportunities that color choice could offer and to avoid “mistakes” of using mismatched lamps in their homes.

Participants felt that color choice could be a valuable benefit for consumers if they were given guidelines on how to decorate better with the color options offered. They imagine application guidelines similar to what one might find on photography film, such as “Use this film for fast action shots on overcast days.” Their interest in avoiding mismatched light sources in the same room supports the reports that color variation is a barrier to acceptance of CFLs. A consistent color communication system could serve both purposes.

The participants’ strong message was that all manufacturers must conform consistently with any color communication system. These focus groups did not consider what tolerances are noticeable and acceptable to the consumer. More research is suggested to identify the tolerance range for each color “bin” on the package, because consumers will want to know, for example, that “B” color will always mean “B” color.

Based on the results of the focus group, the discussions and interpretations of the advisory group, and the interest to link any color communication system to an industry-wide standard color system, a three part color communication system is recommended. Figures 6a and 6b show the recommended system for the lamp package and for the lamp; Figure 7 shows a point of purchase placard for educating the consumer.

The package label has six distinct color squares, each square associated with a CCT color consistency. The lighting industry should reach consensus for the target CCTs and consistencies represented by each square. The American National Standards Institute recognizes six CCTs and tolerance ellipses for fluorescent lamps which would be a logical starting point for discussion.[5] These target CCTs are congruent with ENERGY STAR specifications, except that ANSI cites 4000/4100 K whereas the ENERGY STAR uses only a 4100K target.

The labeling system for the lamp base or bulb shown in Figure 6b has the designated letter in a square that would be printed in black, without color fill. This avoids color printing on the bulb, makes the required area even smaller than on the package, but still allows the consumer to know that they would need a color “B” replacement lamp to get the same color.

The focus groups recommended that consumer education could best be accomplished by a demonstration like the one they saw with the table lambs. A demonstration of that size, however, would be difficult to stage. They thought that the demonstration should be deployed as a “point of purchase” educational demonstration and that it would be most effective at DIY stores where people consider purchases more carefully.

It is recommended that the industry develop a small demonstration placard with six lit color “bins” or squares corresponding to the color squares on the package communication system (Figure 7). It should be powered by a small battery and have a standard design for all manufacturers. It could be hung from a shelf containing light bulbs, its small size minimizing the shelf space required for the demonstration. There would be room on the standard placard for each manufacturer to overlay its own marketing message about color. Perhaps application guideline brochures could also be available nearby.

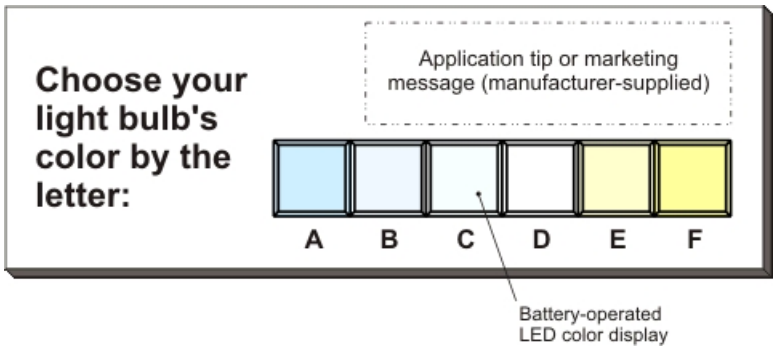


Figure 7: Color communication system recommendation for point of purchase placard

Manufacturers or energy efficient program managers could also use the system to promote their products or programs using color as a positive value. For example, slogans such as “Decorate with color with ENERGY STAR lamps” or “Use Acme letter E bulbs to make your traditional living room feel warm and cozy.” As consumers become more educated through these promotional efforts, they will recognize the letter designations, just as we do now for household batteries.

This three-tiered integrated color communication system: lamp label, package label, and point of purchase placard, has the potential to increase consumer awareness of why and how one should consider lamp source color in their purchases. Manufacturers would be able to market color choice as an improved value proposition for consumers, especially in their CFL offerings, thereby increasing energy efficiency in homes. The benefits should reduce consumer dissatisfaction with color mismatches of their lamps, improve consumer ability to illuminate specific colors or create moods in home decoration, and reduce confusion with the process of purchasing lamps for the home.

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