



# Evaluation of LED Accent Lighting in a Retail Environment

Results of qualitative and quantitative research conducted with shoppers and lighting professionals in House of Fraser, Oxford Street, London

Colette C. Knight  
Lighting Application Specifier



## Introduction

### LED lighting brings retailers and lighting professionals considerable advantages in terms of maintenance and energy saving

Trends in retail innovation suggest that customers are becoming more demanding and expecting of high quality products and experiences when shopping. At the same time, they are also becoming increasingly green conscious.

Artificial lighting is one of the factors that have a profound impact on the atmosphere of a retail setting, the attention-grabbing nature of a display, the appearance of individual products and therefore the overall shopping experience.

The high ambient (~700 lx) and accent (~2000 lx) light levels often used contribute to a substantial proportion of a store's total energy consumption. Therefore it is not surprising that many lighting designers are considering means to reduce the energy consumption as well as the maintenance of store lighting while preserving an inviting and attractive atmosphere.

Moreover, many conventional light sources fail and need to be replaced about every 2 years. Not only is this costly, in terms of

labor, but it also requires stocks to be kept on hand, introduces the risk of error and results in visibly burnt out spots.

Currently, there is considerable interest in using LED lighting to replace halogen in accent lighting applications. This is largely due to the rapidly increasing efficacy and the expected long lifetime (50 000 hours) of LED solutions. This very long lifetime will reduce the maintenance needed and increase the reliability of lighting installations. Moreover, compared to conventional light sources, the light distribution of LED luminaires can be better controlled thereby increasing the utilization.

The efficacies of LED light sources are already more than two to three times that of halogen. However, for most existing LED solutions this comes at the cost of lighting quality, in terms of the color rendering (Ra, R9), and Color Temperature, as well as a

natural white appearance of the light. In particular, the rendering of reds, browns and other warm colors is generally poorer under LED spots than under the halogen spots they are targeted to replace in accent lighting applications. This can reduce the attractiveness of merchandise in a retail environment. With this in mind, Xicato has commercialized two series of LED modules that offer different trade-offs in terms of light quality and efficacy. The light quality of the Artist Series is on par with halogen (i.e. excellent). As such, it is ideally suited for applications where perfect color rendering is critical. The light quality of the Standard Series is on par with compact fluorescent and compact metal halide sources (i.e. good). However the XSM Standard Series has 30% higher efficacy than the XSM Artist Series. As such, it can be the preferred solution in applications where higher efficacy is more important than perfect color rendering.

### Characteristics related to light source<sup>i</sup>

Accent Application	Comments	Ra	R9	CCT (K)	Chromaticity		Lifetime (hrs) <sup>ii</sup>	System efficacy <sup>iii</sup> (lm/W)
					x	y		
1. Energy Saver Halogen <sup>iv</sup> MR 16 12V IRC <b>35W</b>	Reference source for light quality	98	92	2980 K	0.4480	0.4168	< 5000	16 lm/W
2. Xicato Artist Series XSM 9030 – 700 <b>21W</b> (70°C at 700mA)	Light quality on par with halogen	98	92	2975 K	0.4497	0.4195	50000	25 lm/W
3. Xicato Standard XSM 8030 – 700 <b>15W</b> (70°C at 700mA)	Light quality on par with compact fluorescent and compact metal halide down lights	83	24	2945 K	0.4508	0.4180	50000	40 lm/W

i Data provided by Xicato, San Jose, CA

ii Lifetime based on 50% mortality for halogen, and based on 30% lumen depreciation for LED modules

iii Typical system efficacies are given. They are based on light source/module efficacy (35W IRC: 24 lm/W, XSM 9030: 35 lm/W, XSM 8030: 55 lm/W) \* driver efficiency (0.8) \* reflector efficiency (0.8 for halogen, 0.9 for LED spots)

iv Efficacy of energy saving halogen lamps is about 30% higher than efficacy of standard halogen lamps

## Objectives

### Do shoppers and lighting professionals recognize the benefits of higher Ra and R9 of XSM Artist Series in actual retail applications?

This report documents research done with shoppers and lighting specifiers to evaluate the impact of light quality (Ra and R9) on the attractiveness and attention-grabbing nature of colored designer shoes in a display.

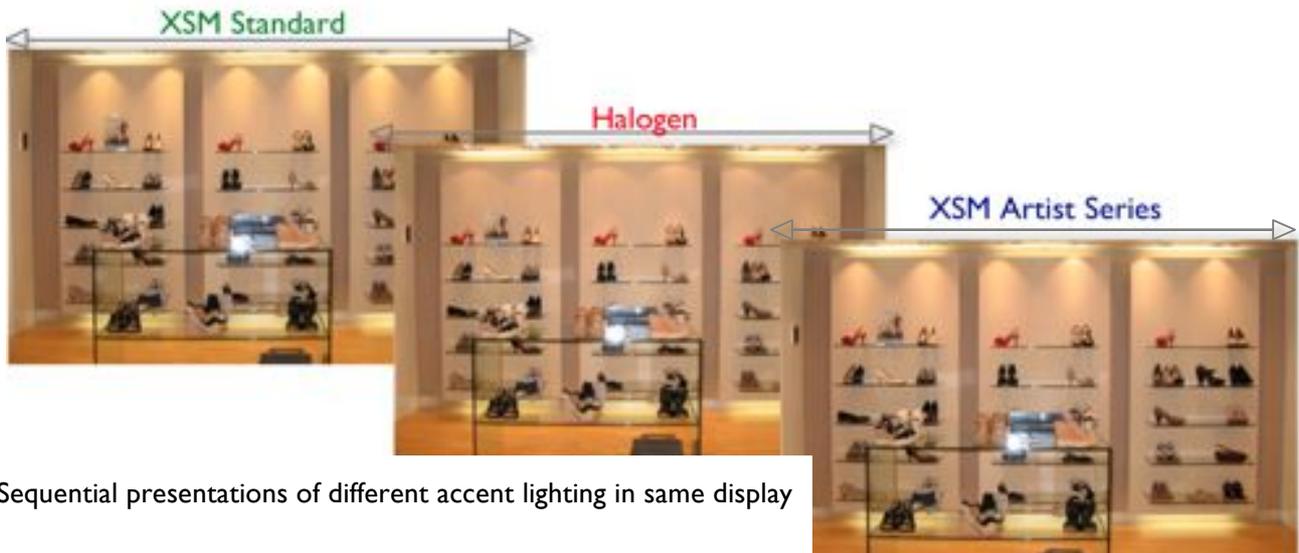
The light sources used varied predominantly in terms of their Ra and R9. The Ra of a light source is indicative of its ability to render eight specified pastel reference colors. The R9 is indicative of its ability to render deep red colors specifically.

While halogen light sources have an R9 of or close to 100, most white LED light sources, CFL (compact fluorescent) and CMH (compact metal halide) sources have an R9 lower than 30. However, as seen in the table above, the Xicato Artist Series has a R9 similar to halogen.

One of the objectives of the research was to determine if shoppers and specifiers recognize the effects of higher Ra and R9 of the Artist Series accent lighting on colored merchandise in an actual retail environment.

Further objectives included direct comparison of the appreciation of merchandise under the Xicato Artist Series and Standard LED spot modules compared to under halogen.

In addition to quantitative research with target shoppers to explore the effect that the quality of the accent lighting has on their perception of the merchandise, qualitative interviews were conducted with a variety of lighting specifiers to gain a deeper understanding of how such professionals perceive the differences in lighting quality between the three solutions.



Sequential presentations of different accent lighting in same display

## Research Set-Up

19 shoppers and 31 lighting specifiers participated in qualitative and (semi) quantitative research to evaluate the attractiveness of colored shoes and attention grabbing nature of displays under three types of accent lighting

### Organization

Xicato commissioned independent lighting application researcher, Colette Knight, to design and conduct research to evaluate the effect of lighting quality on the attractiveness of merchandise and the attention-grabbing nature of displays. Peter Raynham of University College London reviewed the research.

### Test Set-Up

The PIED A TERRE ladies shoe display was chosen as the test location in consultation with the responsible lighting manager at House of Fraser. As can be seen in the picture above, the display used consists of three alcoves. For the purpose of the test, it was necessary to design and install a flexible lighting system, which allowed the same merchandise to be illuminated with different types of accent lighting where ideally only the test variables (in this case Ra and R9) were changed. To this end, a panel was designed by Xicato in

which the accent lighting could be provided by either halogen, Xicato Artist Series and Xicato Standard modules. Two spots of each lighting type were installed per alcove. It was possible to readily switch between the three types of accent lighting for sequential evaluation of the light effect.

While all efforts were made to keep Ra and R9 as the only variables, two other variables were unavoidable in the set-up. First, the background of the display was beige and this specific beige was rendered more bluish under the Artist Series, which gave the impression that the Artist Series modules had a cooler Color Temperature. As can be seen on the previous page, the Color Temperature and chromaticity of all three sources were similar. Secondly, in order to have two spots of each of the three light sources centralized per alcove, it was necessary to put two clusters of the three different light sources per alcove. The

three light sources were clustered in a triangle and not on a line. As a result, the halogen down lights were positioned further from the back wall compared to the two XSM down lights. This affected the beam spread.

The lighting control system also enabled each alcove to be independently illuminated with a different light source – thereby facilitating parallel, side-by-side comparisons of the effect of the light quality on the attractiveness of the display.

The flexibility of the lighting controls therefore allowed two types of evaluations namely: (1) sequential and (2) side-by-side

Realization of the lighting system involved collaboration with Gamma Illumination (luminaires) and RENA (Bits2Power controls).

To ensure a realistic and relevant research set-up, no attempt was made to isolate the display from the effects of the ambient lighting.



Side-by-side presentations of accent lighting in display

## Quantitative Research

Acumen Fieldwork was commissioned to carry out interviews with shoppers. 19 women who shop at House of Fraser or comparable department stores at least six times a year and who have bought at least one pair of colored designer shoes for more than 100 GBP within the last year were recruited ahead of time. They were given specific times to come to the research area. Each interview lasted between 30 to 40 minutes. The interviews were organized between 10am and 3pm (i.e. during opening hours but outside of the store's rush hour) over a three day period.

The research was divided into two parts. In the first part, the respondents were shown the display in which accent lighting in all three alcoves was provided by either halogen, Standard XSM or Artist Series XSM. The order in which the lighting was shown was randomized and balanced between respondents. The respondents were asked to score the display in terms of the effectiveness in grabbing their attention and making the shoes stand out, as well as to rate the vibrancy and attractiveness of the colored merchandise.

In the second part, the respondents were shown the same display, but now with the three alcoves illuminated with the three different types of accent lighting (side-by-side comparison). They were asked to rank the alcoves and explain their choices. The respondents were not told that the solutions they were evaluating in the side-by-side comparison were the same they had previously evaluated individually.

To eliminate impact of position effects, scenarios were programmed in which each of the three accent lighting solutions could be shown in the left, middle or right alcove. In other words, the position of the light source was randomized. This led to six different scenarios for comparison. Each shopper performed two evaluations. All position/lighting combinations were evaluated an approximately equal number of times by the 19 shoppers.

## Qualitative Research

31 lighting professionals with widely varying experience and backgrounds participated in the qualitative research. The 31 included six individual

interviews and four groups of five to seven specifiers. The focus of the qualitative interviews was to get a more detailed understanding of the perception of the different light effects and reasons given for the preferred lighting solution. The specifiers were not told which light sources were being evaluated before the test, but many might have guessed.

Similar to the research with shoppers, the specifiers were also asked to evaluate each of the three accent lighting solutions independently.

Then they were shown one scenario in which all three accent lighting solutions were used and they were requested to rank and compare the effect on the merchandise.

Furthermore, they were asked to indicate the extent of their preference between their first, second and third choice.

Subsequent discussions were used to understand their perception of the impact of the different accent lighting on the atmosphere and attention-grabbing nature of the display and which factors regarding the lighting quality are most important to them in this application.

## Profile of Shoppers



Respondents were selected who shop at House of Fraser and similar department stores for colored designer shoes

The 19 women who took part in the test were recruited in advance according to certain criteria. People working in lighting, electrical engineering, journalism, market research, clothing or footwear manufacture or department store retailing were excluded.

### Age of Respondents

Seven of the respondents were between 24 and 34 years old. Six respondents were between 35 and 49 years old and the ages of the remaining six ranged from 50 to 65.

### Where they've shopped in the last 12 months?

In addition to House of Fraser, the most common department stores where the respondents shop for shoes or clothes are shown in the graph below.

### How often they've shopped in the past 12 months?

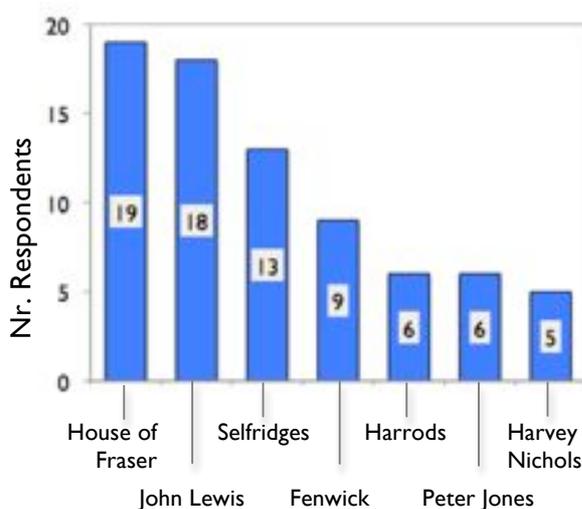
Of the 19 respondents, six said they went shopping for clothes or shoes every six to eight weeks. Nine went every two to four weeks. The remaining four went shopping at least once a week in the past year.

### What they spend on designer shoes?

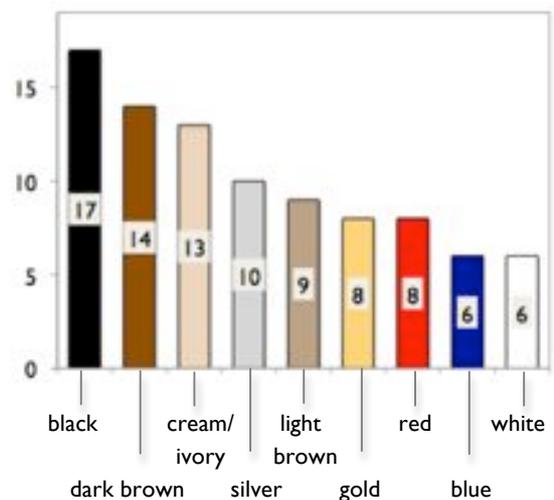
All of the respondents said they bought at least one pair of colored shoes within the last year. Nine respondents said they spent between 100 and 200 GBP per pair on these shoes. Ten respondents spent more than 200 GBP per pair.

### What color designer shoes they own?

The graph below plots the most common color designer shoes owned by the respondents.



Nr. of respondents (out of 19) who shopped in above stores in the last 12 months.



Nr. of respondents (out of 19) who own designer shoes with above color

## Specifiers



*“A fascinating test - good to be a part of this research. I'm more interested to see and understand the shopper's reactions though”*

<b>Nr. of Participants</b>	<b>Company</b>	<b>Website</b>
1	Arup	<a href="http://www.arup.com/Lighting">www.arup.com/Lighting</a>
1	BDP	<a href="http://www.bdp.com/Services/Lighting/">www.bdp.com/Services/Lighting/</a>
Group of 7	Cinimod Studio	<a href="http://www.cinimodstudio.com/">www.cinimodstudio.com/</a>
Group of 6	Gia Equation	<a href="http://www.giaequation.co.uk/">www.giaequation.co.uk/</a>
1	LAPD	<a href="http://www.lapdconsultants.com/">www.lapdconsultants.com/</a>
Group of 7	Light Bureau	<a href="http://www.lightbureau.com/">www.lightbureau.com/</a>
Group of 5	Light Projects	<a href="http://www.lightprojects.co.uk/">www.lightprojects.co.uk/</a>
1	Liminaires Ltd.	<a href="http://www.liminaires.co.uk/">www.liminaires.co.uk/</a>
1	NDY Light	<a href="http://www.ndy.com/services/ndylight">www.ndy.com/services/ndylight</a>
1	Waterman Group	<a href="http://www.watermangroup.com/">www.watermangroup.com/</a>

As can be seen from the table above, specifiers from a number of lighting design companies participated in the research.

The experience of the individual respondents in retail lighting design was diverse: it varied from less than six months to more than 15 years.

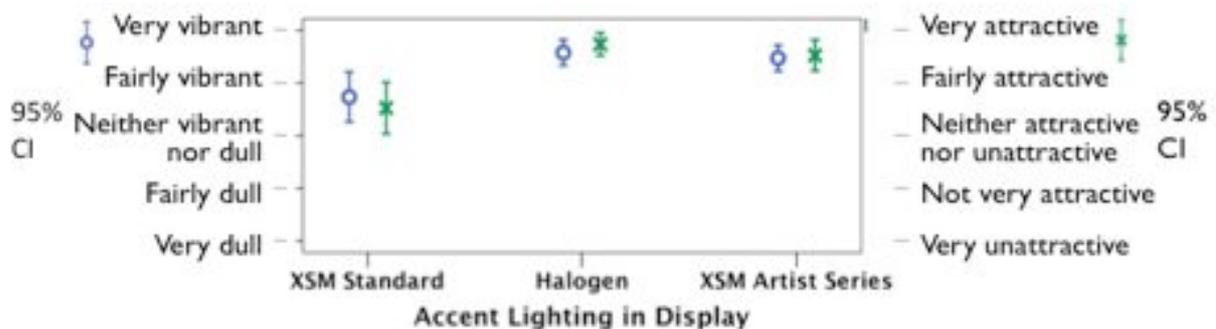
Among the respondents, there were nine women and twenty-two men.

# Results of (Semi) Quantitative Research with Shoppers Sequential Presentations of the display with three types of accent lighting

Shoppers rate the color of red shoes as being just as attractive and vibrant under the Xicato Artist Series as under the reference halogen lighting.

Question: If you look at the color of the red shoes. Does the color look very attractive, fairly attractive, neither attractive nor unattractive, not very attractive or very unattractive?

Question: And how vibrant or dull does the color look? Does it look very vibrant, fairly vibrant, neither vibrant nor dull, fairly dull or very dull?



In the first part of the test, shoppers were shown the display in which the accent lighting was provided by either halogen, Xicato Artist Series or Xicato Standard spots. The order in which the lighting was presented in the display was randomized between the respondents.

The respondents were asked to look at the red shoes positioned on the display and to evaluate on a 5-point scale how vibrant or dull and attractive or unattractive the color appeared to them. Since the tests were done during opening hours while other customers were browsing and shopping for shoes, it was not possible to put many different colored shoes of the same type in each alcove. Red

shoes were chosen since in pilot trials done prior to the actual test, shoppers indicated that bright colors and in particular red, contribute to the attractiveness and attention-grabbing nature of shoe displays. Spontaneous statements made during the actual test further corroborated such statements.

There was no statistically significant difference according to a t-test ( $p > 0.05$ ) regarding how the shopper respondents evaluated how vibrant and attractive the color of the red shoe appeared under halogen or Xicato Artist Series accent lighting.

There was a statistically significant difference in how vibrant and attractive the red color of the shoe appeared under the Xicato Standard compared to under halogen or Xicato Artist Series.

As can be seen in the graph above, under the halogen or Artist Series spots, the red color was rated on average between fairly attractive and very attractive and between fairly vibrant and very vibrant.

Under the Xicato Standard with Ra and R9 comparable to compact fluorescent and ceramic metal halide down lights (i.e. Ra 80, R9 < 30), the red color of the shoes was perceived to be less vibrant.

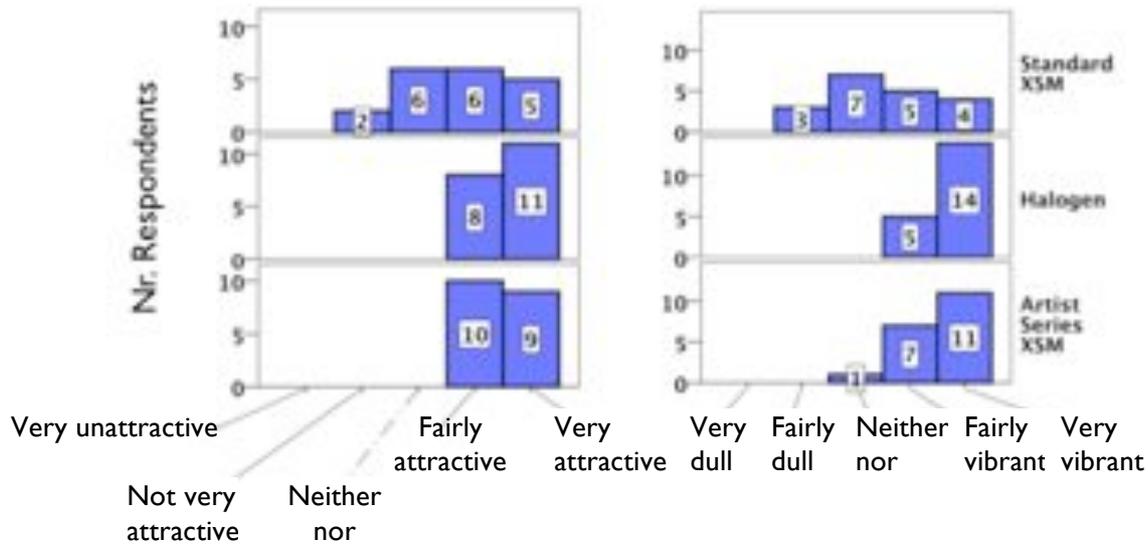
The histograms plotted below summarize how the 19 shoppers individually rated the attractiveness and vibrancy of the red color.

As can be seen, all of the shoppers rate the color as being either fairly or very attractive under both

halogen and the Artist Series. In the case of the Standard LED accent lighting, there is greater spread. While half of the shoppers rate the color of the shoes as either fairly or very attractive or fairly or very vibrant, the other half is less positive.

The reasons given for the different rating are exemplified by a few quotes below.

Using accent lighting with better light quality in terms of Ra and R9 clearly has the potential to draw in the more critical respondents.



Do you think the shoes in the display are...?

How vibrant do the colors look? Are they...?

*“Deeper red says ‘clubware’. Looks classier compared to orange-red”*

Verbatim from shoppers related to the attractiveness and vibrancy of the colored shoes under the three different types of accent lighting used in the test

XSM Standard  
(Ra and R9 on par with compact fluorescent and compact metal halide)

*“The red shoe looks a rusty color – slightly dirty red”*  
*“It looks washed out – as if it’s been exposed to too much light”*  
*“The color looks different from the others – more orangey-red and orangey-red screams cheap, trashy”*

Halogen

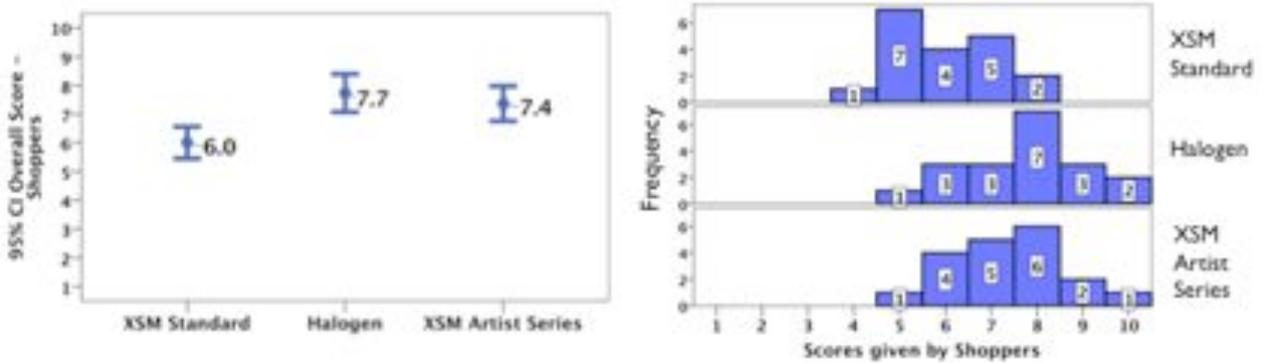
*“It’s the brightest, nice color and nice shine on the buckle – it stands out so much more”*

XSM Artist Series

*“Deeper red says ‘clubware’. Looks classier compared to orange-red”*

# Shoppers recognize that XSM Artist Series helps draw their attention to merchandise by making colors appear more vibrant and attractive

Question: Please give an overall score out of 10, which indicates how effective you think the lighting in this display is in terms of grabbing your attention and making the shoes stand out. 10 would be excellent, 1 would be very poor indeed



There is considerably more variability in the scores respondents gave when asked to rank the effectiveness of each lighting solution in terms of grabbing their attention and making the shoes stand out.

Nevertheless as can be seen in the graphs above, on average shoppers scored the display lit with halogen and Artist Series higher (>7 out of 10) than when it was lit with Standard (average 6). The histogram shows that there were a

number of shoppers who were not satisfied with the display when it was lit with Ra 80 (R9 <30) LED accent lighting (XSM Standard) and scored it with 5 or lower. This dissatisfaction was not expressed when Xicato Artist Series was used.

*“If you have a beautiful product, but it is not well lit – it won’t draw your attention”*

The respondents were asked which factors influence how attention grabbing a display is.

The main ones mentioned are summarized below with related quotes.

### Angle and positioning of shoe on shelf

*“I like that they’re directly under the light and at an angle so you can see the height of the heel and embellishments from a distance”*

Shoppers recognize that good **lighting** plays an important role in highlighting merchandise.

### Design, color and quality of shoes

*“It’s the design and color that grab my attention”*  
*“It’s the red color that draws you – any bright color would grab my attention”*

### General layout of display

*“I like the display, not too crowded, I can see everything”*

*“If you have a beautiful product, but it is not well lit – it won’t draw your attention”*

*“The brightness makes the color look more vibrant and stick out”*

### Attitude: Shoe-hunting or just browsing

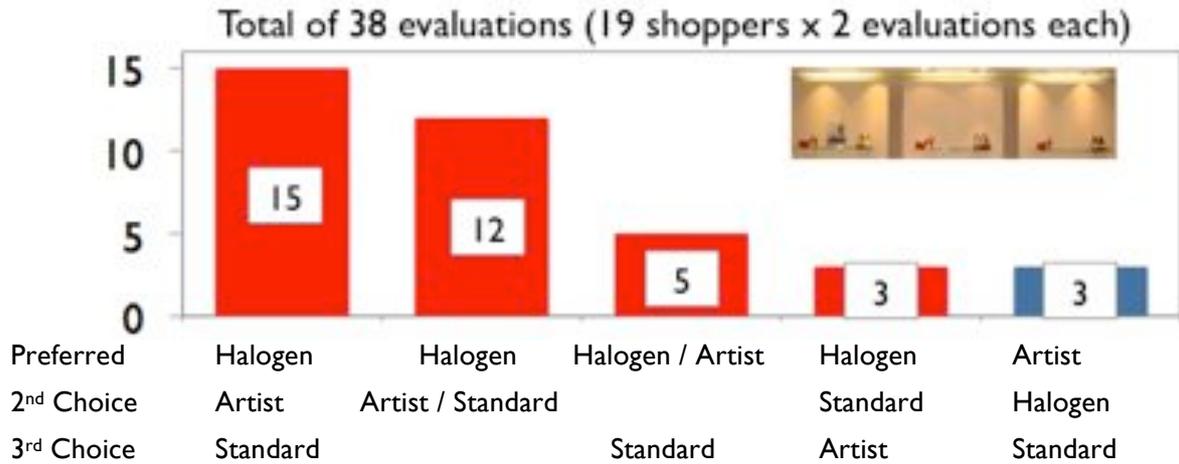
*“I am a shoe friend – I tend to browse all shoes”*  
*“I look for a particular kind of shoe – I generally go for flatter heels”*

### Other accessories in display

*“If there were other accessories like handbags – that would really help – since it would show how to combine things”*

However, shoppers also express that there are a number of other factors, which influence whether or not a display grabs their attention.

## Side-by-side presentations of three types of accent lighting in the display



In side-by-side comparisons, differences in light quality and brightness can have an even greater impact.

In these comparisons, most shoppers preferred the display lit with halogen. This was mostly due to the higher light intensity on the shoes (see illuminance levels below).  
*“The light concentrates on the shoe. It makes the shoe stand out more than the others especially from a distance”*

The display lit with Xicato Artist Series is a strong second choice for most respondents.  
*“It’s pretty much the same as that one (halogen). They both seem a bit more lit up and a bit more vibrant than the other one (Standard)”*  
*“The difference is slight, but the color of the other shoe (under halogen) looks slightly more vibrant”*

About 1/3 of the shoppers do not express any preference between the Artist Series and

Standard (tie in 12 out of 38 evaluations). However for the majority of respondents, the display lit with Standard is less interesting and appealing.  
*“I even question if it is the same shoe”*  
*“I would be bored looking at this display – it does not look well lit to me. If it is not well lit, then they are telling me there’s nothing worth looking at here. Too bad – these are nice red shoes – they deserve better lighting”*

*“The light on the shoe is good, so it makes it look attractive – it doesn’t necessarily need to be the brightest light” (about Xicato Artist Series)*

The main reason the shoppers gave for their preference of the display with halogen over Artist Series was that the shoes

themselves were more brightly lit. This is directly related to light distribution of the halogen and LED spots. The main

reason for the preference of the display when lit with Artist Series or halogen over Standard was due to the vibrancy of the red colored shoes.



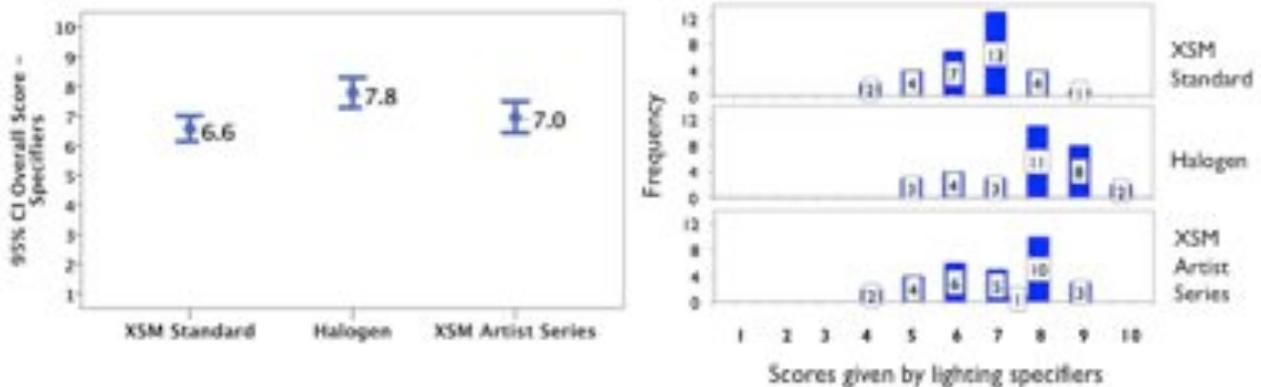
Illuminance levels measured at different points on display (lx)			
	XSM Standard	Halogen	XSM Artist
~E <sub>H1</sub>	~2370 lx	~2900 lx	~2300 lx
~E <sub>H2</sub>	~2270 lx	~1200 lx	~2180 lx
~E <sub>V1</sub>	~1000 lx	~680 lx	~850 lx
~E <sub>V2</sub>	~600 lx	~470 lx	~680 lx

# Results of Qualitative Research with Specifiers

## Sequential Presentations of the display with three types of accent lighting

Good light quality (high Ra, high R9) and sparkle both contribute to highlighting merchandise and making colors appear more vibrant

Question: Please give an overall score out of 10, which indicates how effective you think the lighting in this display is in terms of grabbing your attention and making the shoes stand out. 10 would be excellent, 1 would be very poor indeed



Similar to the research with shoppers, the lighting specifiers were first shown the display lit with either halogen, Xicato Artist Series or Xicato Standard. They were asked to score it on a 10-point scale according to how attention-grabbing it appeared. However, since the focus of the specifier interviews was to get a more in-depth assessment of their perception of the light effect, upon request, the specifiers were shown each display setting a number of times before they finalized their scores.

During the evaluations, specifiers were allowed to temporarily place any shoe from the nearby area in the display. In this way, they could evaluate the appearance of shoes with various colors and textures. Many specifiers placed blue, green, gold, tan and shiny shoes in the display. (For practical reasons this was not done with the shoppers. The shoppers were asked to focus on the red shoes in the display).

Consistent with the results of the shopper interviews, there was a preference for the display lit with halogen. However, as can be seen from the histogram above, about 1/2 of the specifiers scored the display lit with both Artist Series and halogen spots with 8 points out of 10 or higher. Only 1/4 gave the display lit with Standard similarly high marks.

Some specifiers felt that the beige back panel of the display appeared cooler and more bluish under the Artist Series than under halogen or the Xicato Standard. This gave them the impression that the Color Temperature of the Artist Series modules was substantially cooler than that of the Standard modules. These specifiers typically preferred a warmer CCT and took this perceived difference into consideration in their scores. The CCTs were actually quite comparable: Standard – 2945K and Artist Series – 2975K. However the specific beige of

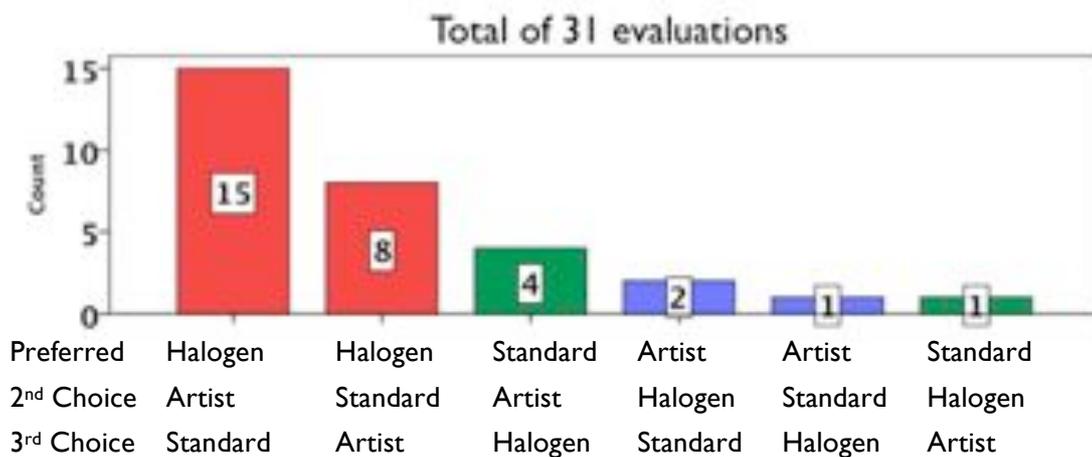
the back panel appeared more bluish under the Artist Series. Some specifiers also noted and preferred the greater ‘sparkle’ or ‘punch’ of halogen compared to the LED solutions. To many, ‘sparkle’ also contributes to highlighting the merchandise. Even though on average, halogen was scored the highest, there was no statistically significant difference between the scores given the display lit with halogen compared to with Artist Series.

Although more high scores ( $\geq 8$ ) were given to the display lit with Artist Series, unlike the case of the shoppers, there was also no statistically significant difference between the scores specifiers gave to the display lit with Artist Series or Standard (due to spread in the scores). The average score given to the display lit with Standard was 6.6 – so reasonably good. But it was statistically significantly lower than the average score given when lit with halogen.



A young team from Cinimod Studio participated in the test

## Side-by-side Presentations of three types of accent lighting in the display



The results of the side-by-side comparisons were consistent with those of the sequential evaluations.

23 out of 31 specifiers preferred the display lit with halogen. The reasons given were mostly related to the higher light intensity on the shoes and resulting higher contrast with the background (i.e. more 'punch'), higher 'sparkle', perceived warmer CCT and Ra.

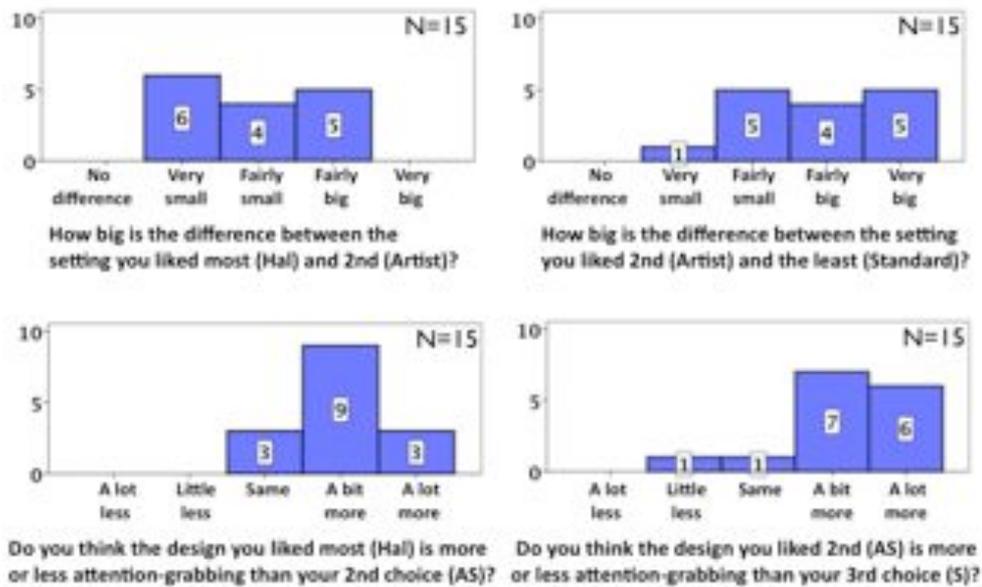
22 out of 31 specifiers chose the display lit with Artist Series as their second choice.

Consistent with the sequential evaluations, most specifiers recognized and appreciated the good color rendering, especially of warm colors, but for some, the perceived cooler Color Temperature of the Artist Series in this display application partly compromised the effect. This perception led to the result that 13 out of 31 specifiers preferred the XSM Standard over the Artist Series. The only reason given by these specifiers for their choice was the warmer CCT of the Standard and the impact that had on the general ambience of the display.

In addition to ranking the lighting in the three alcoves, the specifiers were asked to indicate how small or large their preference was between their choices. The histogram on the following page shows the results for the 15 specifiers with the most common rank order, (i.e halogen (1<sup>st</sup>), Artist Series (2<sup>nd</sup>), Standard (3<sup>rd</sup>)). Despite the variability in the assessments, the trend indicates that the gap in preference between Artist Series and Standard tends to be greater than between Artist Series and halogen.

## Perceived differences between the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> choice settings.

These results are for the 15 specifiers who rated halogen 1<sup>st</sup>, XSM Artist Series 2<sup>nd</sup> and XSM Standard 3<sup>rd</sup> in side-by-side comparisons.



For many specifiers, the difference in preference and vibrancy of colors under the Artist Series and halogen is smaller than the difference under the Artist Series and Standard (Ra and R9 similar to CFL, CMH)

### Halogen Accent Lighting

- + “Good sparkle. Sparkle is very important in retail for attracting attention. You have that with halogen and CDM”
- + “Noticeably sharper and crisper light. Makes products seem more highlighted”
- + “Very attention-grabbing. Focus on product”
- + “Texture is better. See more texture on suede shoes”
- + “Best warm light”
- + “Good / best color rendering”
- “Glary”

### XSM Artist Series

- + “Red is vibrant. Blue also looks good. Maybe even better (than under halogen)”
- + “Shoes definitely looks brighter than under Standard”
- + “A little zingier (than Standard)”
- + “See only a tiny difference in color compared to halogen, tiny but it is there”
- ± “Even tans and shades are differentiated. Highlights are visible, but not as much sparkle as halogen”
- ± “Seems to have the coolest Color Temperature. I prefer the color rendering (of Artist Series), but I prefer the warmer Color Temperature (of Standard)”
- ± “Less nice to look at overall, due to cool Color Temperature, but more attention-grabbing”
- “Not enough sparkle. Buckle, shiny shoes look too dull”

### XSM Standard

- + “Warmer (than Artist Series used in test). Nicer color”
- ± “Blues look OK, but red is not vibrant. In Northern Europe, the appearance of red, of warm colors is very important in retail”
- “Rendering is poor, washed out”
- “Red is not fully alive”
- “Poor colors, dull colors, even on tans”
- “Red looks too orange”
- “Would describe it as flat”
- “Colors do not look quite natural”



## Summary and Conclusions

### Summary of Results (Shoppers)

- Merchandise that looks bright, vibrant and saturated in color helps grab shopper's attention.
- In sequential evaluations, shoppers rate the attractiveness and vibrancy of colored merchandise similarly under halogen and Artist Series. The Xicato Artist Series is a good match for halogen in terms of light quality - there was no statistically significant difference between the two. Therefore a switch can be made from halogen to Artist Series as an energy saving (>50%) and maintenance measure without compromising the light quality in the perception of shoppers. In side-by-side comparisons, more shoppers preferred halogen due to the higher brightness on the shoes with halogen in this test set-up.
- Shoppers rated the display lit with Ra 80 (R9 < 30) LED sources statistically significantly lower than when lit with halogen or Artist Series modules (Ra > 95).

### Summary of Results (Specifiers)

- The color rendering of the Artist Series was generally appreciated by the specifiers and perceived to be on par or very close to that of halogen.
- In general, specifiers felt that warm colors (e.g. reds, tans) looked duller and flatter under the Standard module (Ra, R9 comparable with CFL or CMH) than under halogen or Artist Series. This has a negative impact on the attention-grabbing nature of the merchandise.
- Some specifiers missed the halogen-like 'sparkle' and 'punch' with the LED modules. For them, 'sparkle' and 'punch' of point sources contribute to attention-grabbing by highlighting merchandise on a display.
- Perceived Color Temperature has an important influence on the ambience and attention-grabbing nature of displays. Some specifiers felt that the CCT of the Artist Series modules installed in this test was too cool (based on the appearance of the beige back panel) and they took this into consideration in their evaluations of the Artist Series.

### Overall evaluation of set-up

- The test set-up was strong in that it was in a real application (flagship store of House of Fraser in Oxford Street) with full background lighting. No attempt was made to isolate the display to exaggerate the impact of the display lighting.
- All efforts were made to keep the test variables (Ra, R9) as the only variables. However, since the test was done in an actual store and not in a controlled environment, a few other variables were inadvertently introduced – the back panel of the display was rendered differently by the two LED modules and the beam characteristic of the halogen spots was different from those of the LEDs. As a consequence, the average illuminance level on the shoes was higher in the case of halogen.

### Conclusion and Next Steps

During the test, shoppers were asked to stand and study a display in a way they normally would not. Nevertheless, some of the spontaneous comments they made regarding what attracts their attention to a display suggest the following conclusions and potential next steps:

- Use of light sources in retail applications that enhance the attractiveness and vibrancy of colors can contribute to drawing more shoppers to the targeted area.
- The sales in the test area will be logged over the next several weeks, as the accent lighting in the test display is changed on a weekly basis between the three different sources used in the test.

We would like to acknowledge all of the shoppers and lighting professionals who participated in this test. We are especially grateful to House of Fraser for their forward thinking approach to their store lighting, for allowing this research to be carried out, for identifying the test's location and for supporting its installation. Thank you for your help and active participation.

**For more information on Xicato contact:**

**Roger Sexton** on +44 7525715497(EU) - [roger.sexton@xicato.com](mailto:roger.sexton@xicato.com)

**Noboru Kaito** on +81 50 5534 3168 (Japan) - [noboru.kaito@xicato.com](mailto:noboru.kaito@xicato.com)

**Ron Steen** on +1 847 380 2773 (US) - [ron.steen@xicato.com](mailto:ron.steen@xicato.com)



