FIVE STARS - WOULD TOTALLY BUY AGAIN!!!! A NOVEL METHOD AND DATA SOURCE TO STUDY CONSUMER LIGHTING DECISION-MAKING

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Introduction

This poster presents analysis of consumer opinions and preferences of LED bulbs from ratings and reviews located on home improvement store websites. Prior research indicates that 36% of all LEDs purchased by residential consumers in Massachusetts, and 57% in New York, are from home improvement centers.[1] Retailers in this sector operate internet storefronts with a wealth of information about the lighting products on offer, which visitors are invited to rate and review. This represents an underutilized source of information on lighting decision-making. This poster presents a two-part analysis of data collected from these sources: linear models to determine which bulb characteristics and demographic factors influence ratings, and text mining of reviews to explore the language consumers use when describing different lighting products.

This approach offers several advantages over traditional tools such as focus groups and surveys, including speed, low cost, and the ability to be repeated over an extended timeframe. However, reviewers may not satisfy randomness criteria,[2] and some may be compensated for their reviews, preventing this approach from fully supplanting traditional evaluation methods. Nonetheless, its advantages make it an attractive choice to supplement traditional methods to provide additional insight and avenues for further research.

Methodology

The authors created custom tools to collect bulb and review information from retailer websites. Using Cohen's d of 0.80 for large effects, and an α of 0.10, a minimum sample of 34 reviews was required. We collected characteristics for all models of LED for which the sum of all available reviews exceeded this threshold (165 separate SKUs). This set was later limited by other criteria, namely bulb shape and EPA watt equivalence.

We also gathered 1,817 individual reviews of 14 popular SKUS (those present in five or more homes of NMR's panel survey) for sentiment analysis with labMIT v1.0,[3] and frequency analysis of common terms parsed from the text with the ENJU phrase structure grammar engine.[4] Additional processing of the ENJU output was required to limit the results to select phrase forms,[5] consolidate phrases by stemming,[6] eliminate stop words, and remove sub-ordinate clauses in negated phrases. For example, the phrase, "Not too bright, nor expensive, these bulbs are awesome!" is parsed as:

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[1] http://ma-eeac.org/wordpress/wp-content/uploads/Lighting-Market-Assessment-Consumer-Survey-and-On-Site-Saturation-Study.pdf

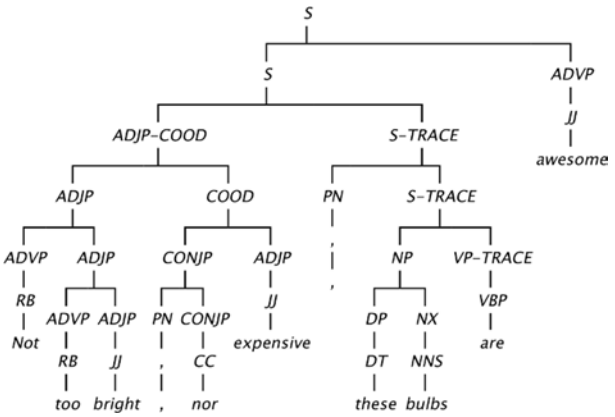
2 Li, X., & Hitt, L. M. (2007). Self Selection and Information Role of Online Product Reviews. https://faculty.wharton.upenn.edu/wp-content/uploads/2012/04/Self-selection.pdf

[3] Dodds P.S., Harris K.D., Kloumann I.M., Bliss C.A., Danforth C.M. (2011). Temporal Patterns of Happiness and Information in a Global Social Network: Hedonometrics and Twitter. PLoS ONE 6(12): e26752. doi:10.1371/journal.pone.0026752

4 http://www.nactem.ac.uk/enju/

5 Adjective (ADJP), adverb (ADVP), verb (VBP), and noun (NP) phrases.

[6] A process that equates words with the same root e.g; bright and brighter or bulb and bulbs.



- ~~Not~~
- Not too bright
- Not too bright, nor expensive
- ~~expensive~~
- ~~these bulbs~~
- ~~are~~
- awesome

Results

Analysis of the collected data supports and contradicts many common beliefs about consumer lighting preferences. For example, it is generally accepted that consumers prefer warm, incandescent-like bulbs, and that price is of utmost concern when choosing a product. However, an automated linear model of all available characteristics[7] for forty-three 60W-equivalent LED A-line SKUs revealed that five key characteristics are sufficient to predict the average rating for this class of bulb with 71% accuracy (N=6,000). Table 1 below shows that while price and color temperature of the light are important, the brand of a bulb is the most significant predictor. Furthermore, an analysis of the relationship between color temperature and reviewer rating for these same bulbs and thirty-five 40W-equivalent A-line LEDs, controlling for wattage equivalence, indicates that customers are more satisfied with daylight bulbs. The correlation between ratings and bulb temperature is 0.466 (p=0.000).

Table 1: Top Five Predictors of LED Bulb Rating

Dimension	Weight	Correlation
Brand	32.0%	N/A
Color Temperature	19.1%	Positive
Price	18.0%	Negative
Efficiency	15.5%	Negative[8]
Warranty Length	15.0%	Positive

One less surprising finding is that anonymous users give lower ratings than male and female reviewers, 0.25 stars (p=0.000) and 0.34 stars (p=0.002) respectively; there was no difference between ratings by males and females. However, the emotional sentiment of review text by sex (male, female, unspecified) and age group, was indistinguishable.

Similarly, analysis of 25 models of bulb (16 A-line, 9 reflectors) available in multiple packages with different quantities of bulbs reveals that customers rate larger packs of bulbs 0.17 stars higher than lower count packs (p=0.053). The cause of this relationship is unclear, because the 43¢ per bulb bulk discount was not significant.

[7] Average Life, Average Rating, Brand, Color Rendering Index, Color temperature, Dimensions, Dimmer compatibility, ENERGY STAR status, Efficiency, Indoor/Outdoor suitability, Lumens, Model, Package Count, Price, Shape, Shatter resistance, Warranty availability/ duration, Wattage & equivalence

8 Efficiency has a statistically significant negative Pearson correlation with price (-0.625), life of the bulb (-0.502) and dimmablity (-0.420).