Journal of Applied Packaging Research

Volume 9 | Number 2 Article 1

2017

Consumer Appeal of Injection IML Packaging vs. Similarly Decorated Glass Jars, Composite Cans, and Metal Cans Using Eye Tracking Technology

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Journal of
APPLIED PACKAGING RESEARCH

RESEARCH ARTICLE

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ABSTRACT

Customers shopped for a set of control packages (i.e. decorated composite cans, metal cans, and glass jars) vs. similarly decorated experimental packaging {i.e. injection in-mold labeled (IML) plastic containers} in CUShopTM. Sonoco Institute of Packaging Design and Graphics, Clemson University. The objective was to determine if IML decoration affected a shopper's point of sale interest vs. non-IML methods of package decoration. Eighty-one volunteer participants wore eye tracking glasses and shopped for 5 products (3 of interest) over three days. Day one, control packaging data was collected; day two, IML packaging data was collected; day three, control and IML packaging positioned side-by-side data was collected. Quantitative analysis was completed for eye movements from each participant and in aggregate. Qualitative observations were recorded via a post experiment survey each day. Results showed that participants trended towards finding IML packaging faster than any of the controls; however, there were no statistically significant differences ($P < 0.05$) between the IML decorated samples vs. the control decorated samples for the Time to First Fixation (TTFF) and Total Fixation Duration (TFD) metrics. Because a fundamental difference between control packages and IML containers was the decorating process, the many benefits of IML were not represented in this study. It was hypothesized that the IML containers would rank equal to or better than the control packages. From the perspective of the researchers, data is compelling because IML packaging is new to the tested categories; and it was compared against traditional packages and products. The use of eye tracking applied to injection IML packaging is also novel in this field.

KEY WORDS

Packaging, eye tracking, consumer behavior, packaging design

1.0 INTRODUCTION

Packaging must sell a contained product while preserving shelf-life quality. These subjects are integrally interrelated; however, this paper addresses the former.

A package's visual appeal to influence consumption occurs through geometry, text, and graphics. Geometry is relatively easy to recognize – round, oval, square, scround (hybrid round and square design), rectangle, tall, squat, etc. Each has benefits dependent upon anticipated shelf-presence and ergonomic feel. However, all geometries must be decorated to sell products. One method is in-mold labeling (IML).

IML is a manufacturing technique that utilizes pre-decorated, die-cut laminated film or composite that is inserted into a mold during package manufacture. Applicable to injection, thermoformed, and extrusion blow molded plastics, a fundamental advantage of IML vs. other methods of decoration is picture perfect graphics that are precisely positioned within each package. Kraft's Philadelphia cream cheese, Smucker's Jif Whips, and Tropicana's plastic orange juice bottle are injection, thermoformed, and extrusion blow molded packages, respectively, that utilize an IML. Breyers ice cream lids are examples of an injection composite IML.

IML technology was developed in Europe in the 1970s and adopted in North America later in the same decade [1]. IML decoration has been on North American supermarket shelves and within consumer's homes for decades. IML decorated packaging has been adopted globally [1].

IML decorated packages have not been commercialized in all markets. For example, composite cans are easily associated with nuts (e.g. Planters® branded nuts); metal cans are used for shelf-stable meats (e.g. various brands of chicken); and glass jars contain numerous shelf-stable salsas. There are a myriad number of non-food and food products associated with each of the identified package formats. Thus, one of the compelling arguments all packaging companies must successfully resolve when attempting to supplant a commercially accepted package technology is how an alternative technology will affect sales and market share. It is reasonable to conclude that brand owners want quantifiable, statistically significant data when making such decisions [2].

The eye tracking study paired with a post-survey discussed herein was envisioned to gather such data.

2.0 BACKGROUND

Packaging shelf presence is one of the biggest factors pertaining to design [3]. Seventy percent of purchase decisions are made at the shelf; 85% of purchase decisions are made without handling a competitive product; and 90% of purchase decisions are made when looking at just the front face of a package [4].

Packages must have an attractive shelf presence to drive sales. Slogans, claims, and descriptive phrases and design elements enhance the value of the package as a selling tool [5]. Consumer goods companies continually look for ways to increase the shelf presence of their products [6]. Enlarged surface area of the primary display panel has been shown to correspondingly increase gaze time [7]. There is a strong relationship between a package's decorated surface size upon fixation and choice. As decorated surface size increases, so too is the likelihood that consumers will look at it longer and choose it [8].

Even though studies have demonstrated the importance of surface size on fixation and choice, little research has evaluated the difference in consumer attention of comparing an IML container to traditional methods of package decoration. It is important to determine attention retention because a label's design will ultimately determine how well it communicates with consumers [9]. A widely used method to quantitatively evaluate the effectiveness of package design is eye tracking, which measures a person's point of view [9]. Eye tracking can provide insight to what draws an observer's attention and cognitive processing [10].

Eye tracking provides accurate and objective data, and helps determine what visually attracts consumers [11]. Since the average shopper encounters approximately 300 products per minute, no more than five to seven seconds are spent examining packaging [12]. Within five to seven seconds, eye tracking studies have proven that customers focus on only three to four design elements: brand identity, main visual, product description, and a claim [13]. A package's creative design appeal must quickly connect with shoppers.

3.0 METHODOLOGY

3.1 Location and Stimuli

The study occurred in CUShop™, a consumer experience laboratory in the Sonoco Institute of Packaging Design and Graphics, Clemson University (Figure 1). CUShop™ is a realistic shopping environment featuring three 12-foot shopping aisles, frozen food and produce displays, and simulated open refrigeration. This study was conducted

Figure 1. CUShop™

Figure 2. IML (a) and Control Mixed Nuts (b)

Figure 3. IML (a) and Control Salsa Packages (b)

Figure 4. IML (a) and Control Chicken Packages (b)

to determine how customers shopped for products with traditional post-converting applied labels vs IML. IPL Plastics (Levis, QC Canada; www.ipl-plastics.com) provided decorated control and IML stimuli packaging for mixed nuts, chunky salsa, and premium chunk chicken breast (Figure 2-4).

3.2 Planogram

Stimuli were organized into planograms on three different shelves with products similar to their specific product category. Participants were asked to shop for mixed nuts, salsa, or chicken breast. Data was collected over there days, with a different set of volunteer participants per day. Day one, control packaging data was collected; day two, IML packaging data was collected; day three, control and IML packaging positioned side-by-side data was collected. Testing on the third day was performed only as a side by side comparison. Data was not included in the analysis because it has been found that when a person sees multiple variations of the same piece, it alters their behavior. Participants tend to look for what's changed in the planogram and that can negatively impact data. Thus, while showing product within a shelf array, it is a best practice for eye tracking studies that each person should see only the execution of the test brand (i.e. monadic study design). An example of the shelf set-up for day three is illustrated (Figure 5).

Figure 5. IML and control premium chunks arranged on the shelf

3.3 Eye Tracking Apparatus

Tobii Eye Tracking first generation glasses were used to track volunteer participant's eyes. This setup includes mobile eye tracking glasses, IR markers, a recording assistant, and Tobii Studio eye tracking software. Eye tracking glasses were calibrated to the participant's eyes to accurately track eye pupil movements. The recording assistant is hardwired to record tracking and visual data with a standard transferrable secure digital (SD) memory card. IR markers have a transmission range of 60–250 cm at angles between 90° and 150° and are positioned around the packages being tested [14]. After the completion of the study, eye tracking data was transferred to Tobii Studio eye tracking software for analysis.

3.4 Experimental Design

Control and IML stimuli were placed next to each other and positioned individually on shelves and rotated by day. Areas of Analysis (AOAs) and Areas of Interest (AOI) were mapped on each stimulus with Tobii software. The location grid of IR markers on store shelves determines the AOAs, which is the area where eye tracking data is recorded for each participant [14]. The AOI is located inside the AOA and is specifically mapped for each IML stimulus. AOI control and IML stimulus eye tracking data was compared.

Following calibration, participants were given a shopping list and instructed to enter CUShopTM and select a product for each item on a predetermined list. Participants were instructed to shop for chunked chicken breast, salsa, and mixed nuts. The shopping list order was randomized to force participants to shop the entire store.

3.5 Procedure

Prior to the study, each participant was enlisted via a CUShopTM data base and given an "ID code" to ensure confidentiality. Following a 9-point calibration, participants were handed a shopping list with the stimuli and other items and asked to shop for the identified products. Shoppers were instructed to record the shelf location of a chosen item. When participants finished shopping, they exited CUShop™ and were debriefed. They were asked demographic (e.g. age, biological sex, income, etc.) and qualitative questions specific to IML and control stimuli to determine their perception of varied labels.

3.6 Data Collection and Eye Tracking Metrics

AOAs and AOIs were pre-determined for control and IML stimuli. AOI's were used to determine Time to First Fixation (TTFF) and Total Fixation Duration (TFD). TTFF is the time, in seconds, when a product first enters a participant's field of view until they fixate upon it. The lower the number, the quicker the package caught the consumers' attention. TFD is the time, in seconds, spent on average by participants fixating on this item. The

higher the number the more attention the consumer focuses on the package.

3.7 Qualitative Data Collection

Survey data was collected post hoc using an online survey system. After each participant finished the eye tracking exercise, they were led to a computer to answer questions about the products being tested. The same survey was utilized throughput the study; after the completion of the study, responses were downloaded and complied into graphs. Open ended responses were organized by question and broken down into major themes and key statements.

4.0 RESULTS AND DISCUSSION

4.1 Survey Findings.

Eighty-one volunteers (24% male, 76% female) participated in the study. With an age range of 18 to 65+, the majority (54%) were 21-39 years old. Participants were well educated - 27 % had a bachelor's degree and 37% had a graduate degree. Post survey questions addressed the perceived benefits of IML - high quality package/labels, sustainability, and ease of use (Figures 6-8).

Participants found the IML chicken package to be 19% higher quality than the control can. The glass salsa package was viewed as higher quality by 35%. Mixed nuts packaging consistently received the "Neither A nor B" decision (48% for quality), with 49% evenly distributed among the control and stimuli packaging. Therefore, mixed nuts packages were seen as similar quality. IML may be considered higher quality than the competing labeling processes since the label is actually embedded into the container's wall. Scuffing and tearing is not likely to occur [3].

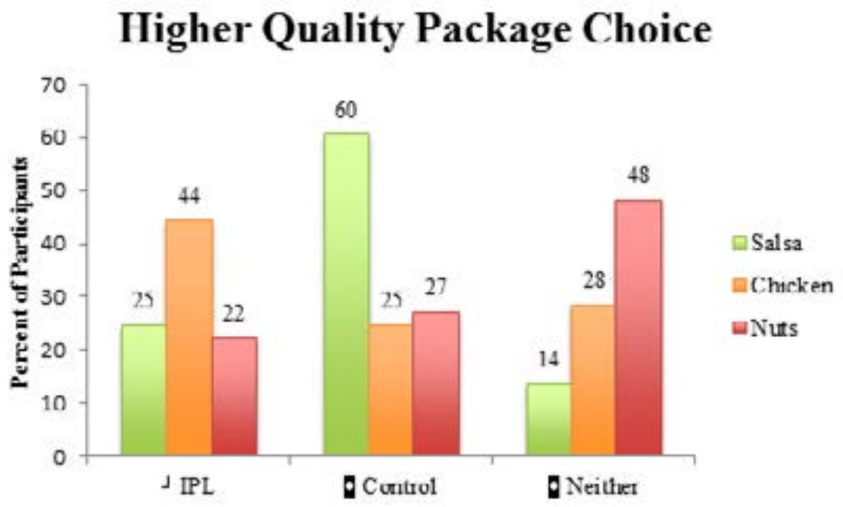

Figure 6. Participant post-survey decisions on package quality.

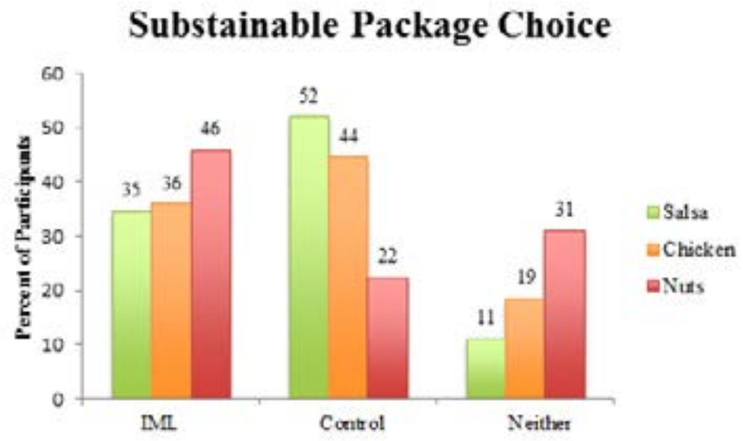

Figure 7. Participant post-survey decisions on package sustainability.

Perceived sustainability is an impactful attribute in overall consumer packaging appeal. Participants were asked which package communicated sustainability. Figure 7 illustrates the qualitative results with only the mixed nuts IML package showing an increase in perceived sustainability (24%). Thirty-one percent of respondents decided that neither control nor IML packaging communicated sustainability. Both salsa and chicken IML packages were perceived as less sustainable than their control counterpart (17% and 8%, respectively).

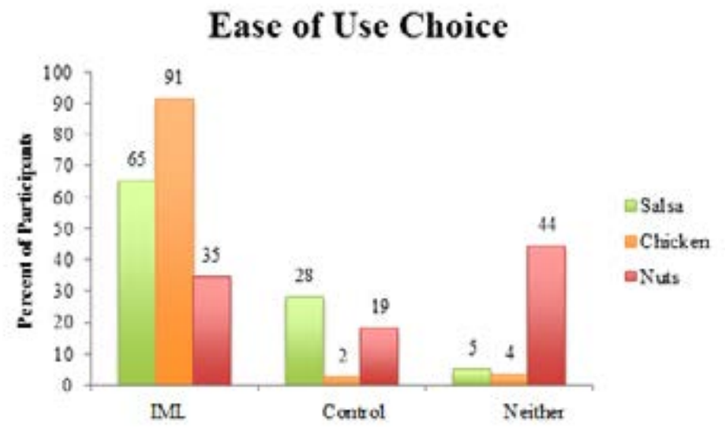

Figure 8. Participant post-survey decisions on package ease of use perception

Another key feature of IML packages is their ease of use with removable lids. Both salsa and chicken IML packages were perceived significantly easier to use than glass and metal cans (37% for salsa, 89% for chicken). The IML mixed nuts package was viewed to be 16% easier to use than composite cans. However 44% of participants also believed that neither package had an easier to use advantage.

Participants were also asked to explain their reflections about IML packaging and why they would choose one package over another. The IML chunked chicken container was considered higher quality, reusable, and kept food fresher. Responses included, "Opening a can is sometimes difficult whereas the plastic container is easier to use", and "Chunked chicken in a plastic container gives me the impression that it's fresh packaged. Canned chicken does not give me the impression of fresh and delicious." Participants concluded that the IML salsa container kept food fresher, would be more reusable, and easier to use. Responses included, "It seems like the salsa would be fresher. I would reuse the package", and "I think it is easier to use, you would not need another bowl to pour in, you could just dip chips in this one." Respondents concluded that the IML mixed nuts container lacking metal is a positive, such as "You would not cut your hand on the metal ring", and "No need to have a metal can with nuts, this is lighter in weight and easier to transport and store."

4.2 Eye Tracking Results and Statistical Analysis

Eye tracking raw data was analyzed using Tobii Studio and SAS® Studio for participant mean, standard deviation, and standard error for TTFF and TFD control vs. IML stimulus. Data was tested for normality using the Shapiro-Wilk test, and data was determined to be non-normal. A t-test was thus conducted in SAS® based on the Central Limit Theorem. This states that for $N > 30$, the sampled population will be normally distributed, and since a sample size of greater than 30 was used herein, a parametric test such as a t-test can be used. A t-test was run comparing the means of control and IML stimuli to determine if there was a significant difference between the labels. In addition to t-tests, a non-parametric Wilcoxon Rank Sum test was used to test the population means in order to cross check t-test results. The results of non-significance were consistent for both the Wilcoxon Rank Sum test and t-test. Table 1 shows the results of the two hypothesis tests.

Test Statistics					
	Wilcoxon Rank Xum Test			Paired T Test	
	Control vs. IML	Z	Asymp. Sig (P-Value)	df	Sig. (2 Tailed) P-value
TTFF	Salsa	-0.414	0.679	19	0.384
	Chicken	-0.534	0.594	13	0.724
	Nuts	-0.784	0.433	19	0.404
TFD	Salsa	-0.896	0.37	19	0.255
	Chicken	-0.973	0.331	13	0.255
	Nuts	-0.149	0.881	19	0.933

Table 1. Test Statistics for control vs IML stimuli TTFF and TFD

With p-values ranging from 0.255 to 0.933, there was no significant difference between the control and the IML stimuli using $\alpha = 0.05$ (Table 1). These results demonstrate that there is not sufficient evidence at a 95% confidence interval to conclude that IML has a shorter TTFF and longer TFD than their control counter parts. While IML packages may not be faster to attract consumer attention or retain attention for longer durations, data also show that IML packages are no less successful than their control counterparts. Based on the fact that participants did not significantly look at either label first or longer, the other benefits such as usability of IML packages become increasingly important. Overall, it was found that IML packaging communicated high ease of use for all products tested (up to 89% greater than control). The IML chicken packaging was found to have a strong usability and quality perception over the traditional canned chicken package. With the IML segment currently accounting for only two percent of the total volume of label printing worldwide, the results concluded herein carry even more significance [15]. Since no significance was found between the two labels in terms of eye tracking metrics, brand owners and marketers can focus on the advantages of IML decoration such as green credentials and varied surface finishing options since the packaging is produced and the label is applied in a single step [15]. Varied post-eye track survey results comparing IML to traditional labeling may be due to consumers being unfamiliar with IML packaging. The average consumer may not recognize there is indeed a label on a specific product even if text and graphics are noticeable [16].

5.0 CONCLUSION

Quantitative data prove that there is no statistical difference between IML packaging and traditional labels, which shows that the effect of design is outside of the manufacturing process, empowering designers. These results provide a strong baseline study that positions IML packaging as equally impactful, stimulating, interesting and appealing to traditionally labeled package substrates such as composite cans, metal cans and glass jars. Consumer qualitative data indicates a strong perceived "usability" feature for IML packaged goods, as well as easy opening. Since IML decorated packages are not utilized in all product markets, results discussed herein support the extended use of IML for mixed nuts, chunked chicken, shelf-stable salsa, and numerous other non-food and food products. Composite cans, metal cans, and glass jars were used as a comparison to IML packaging because they are ubiquitous in the industry. Since the only difference between control packages and IML containers was the decorating process, the many benefits of IML were not represented in this study. It is recommended that additional research pertaining to package geometry would be enlightening. IML could then be compared in varying shapes to traditional post-converting applied labels to investigate if it is indeed geometry, IML decoration, or both that increases consumer attention. A limitation of this study would be the sample size. Though sufficient to do proper analysis, a larger sample size would be ideal to increase the chance of finding significant differences amongst the control and stimuli. Ultimately, the use of IML provides a primary display panel that is modern, simple, and uncluttered, while at the same time providing ample room for product details. This study proved that consumers' attention is the same for IML and traditional packaging which should be positive results for the industry. This research is a stepping stone for the packaging industry to utilize a technology that is continuing to evolve.

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