Effectiveness of Graphic Design in Packaging

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Figure 1: A sample of the tested stimuli

1 INTRODUCTION

In this study, we examine individual responses to graphics used in product packaging. Many companies invest large amounts of money in the graphic design of their brand, but how can they know for certain if a design will interest buyers. This study attempts to determine if there are any patterns or preferences in how individuals look at packaged products. With the data gathered we may be able to better understand what designs consumers are interested in and aid graphic designers of packaged products.

Keywords: Graphic Design, Marketing, Eye Tracking, Consumer Preference

2 BACKGROUND

Graphic design in packaging is used not only to convey information about the product, but also to establish a brand identity for the company making the product. Many companies attempt to establish their own brand identity through the use of their graphic and structural package design in order to better make their products stand out more to consumers [Connolly and Davison, 1996, Aaker and Biel, 1993]. This is especially important because research has shown that 76% of all purchasing decisions are made while a consumer is inside of the store [POPAI, 1997, Inman and Winer 1998].

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Therefore, graphics that catch a consumer's attention while they are shopping can obviously increase sales dramatically. In addition, thousands of new brands and products that go to stores every year and must form a client base [Kotler and Armstrong, 2006, p. 274]. For these reasons companies are striving to use their packaging graphics to develop their brand identity [Aaker and Biel, 1993] and they have begun putting larger amounts of money into their graphic design and brand identity [Kahn and McAlister 1997], now they need to determine if their graphics are effective.

3 METHODOLOGY

3.1 Apparatus

The eye tracking apparatus used for this study was a Tobii model ET-1750 video-based corneal reflection (binocular) eye tracker. This apparatus was used to gather real-time gaze coordinate measurements while also recording them to view later. The ET-1750 has a 17-inch screen and was used at its full resolution of 1280x1024 pixels. The machine's sampling rate was 50Hz with an accuracy of 1 degree of visual angle [Tobii, 2003]. Participants used a chin rest, placed approximately 50cm (the eye tracker's focal length) away from the screen.

The server running the eye tracker during this study was a Sun model W2100z running Windows XP with a Dual 2.0 GHz AMD Opteron 246 DPU and 2 GB of RAM. This server ran on a 1Gb network, and used an nVidia NVS280 video card.

The client computer was a Sun Ultra 20 running Linux 2.6.11 OS with a 2.2 GHz AMD Opteron 148 CPU and 1GB of RAM. The client ran on a 1 Gb network and utilized an nVidia GeForce 880 GTX video card.

3.2 Stimulus

Figures 2-5 display the four stimulus images that were created by the researchers for use in this study. Each stimulus was designed to gather specific data of interest. The areas of interest were as follows: 1) Does a face on a package drive a participant's eyes to look at certain areas more? 2) Do participants show any color preference to certain packaged products? 3) Does a participant have a preference to how certain elements are positioned or located? 4) Do subjects prefer graphics with clip art and more vibrant colors more than simplistic designs? 6) Do participants spend more time looking at products that they prefer, or those that they dislike?

Figure 2: Stimulus image designed to observe if a model's eyes affect gazes.

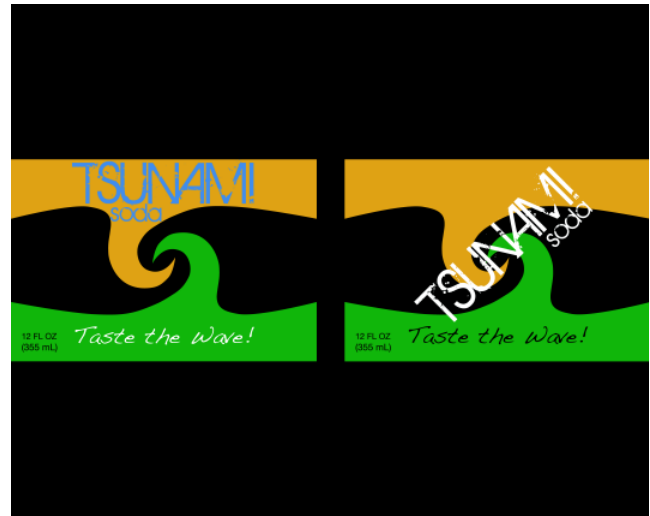**Figure 3: Stimulus image designed to observe if subjects have color preferences.**

Figure 4: Stimulus image designed to observe if placement affected subject's choice.

Figure 5: Stimulus image designed to observe if subjects preferred graphic faces over plain designs.

3.3 Hypotheses

The outcomes from this study dealt with how consumers interact with and make decisions about packaged products. As researchers, we hypothesized that the majority of participants would spend more time looking at the packaged products they liked, rather than the products they disliked. Another expected outcome was that participants would spend more time looking at the eyes of a person on the package, rather than at the elements that deal with the contents of the package. It was also predicted that most customers have expectations of certain colors associated with particular packaged products.

3.4 Subjects

The participants in this study were 18 college students at Clemson University between the ages of 19 to 41. These participants were verbally recruited and received no monetary or class-credit compensation for their participation.

3.5 Experimental Design

The experiment consisted of showing subjects four images. Each image contained two similar product packages with slightly different graphics from various consumer product markets. The participants had 18 seconds to look at each image, during which their eye movements were recorded. After each image the participant was taken to a screen where they chose which product they preferred by fixating with their eyes on a number where the image used to be. The focus was placed on determining what aspects participants focused on and which graphic designs they chose. The order and arrangement of the images was randomized so that the study was balanced to limit the effects of random eye movements before and after each image.

3.6 Procedure

Upon arrival, participants of the study were greeted and led to one of the Tobii Eye Tracking monitors in the lab. The experimenter then provided a brief overview of the purpose of the research and how the study would proceed. Next, the experimenter provided the participant with an informational letter about the study for their records. Next, the experimenter assisted the participant with the chin rest and placed them in the proper position in front of the eye tracker. The participant was then calibrated to the eye tracker. To do this, the participant was informed to follow the dot that would appear on the screen without trying to predict where it was going. Upon completion, the computer would inform the experimenter if it had calibrated correctly. If the calibration was unsuccessful, then the experimenter would help the participant adjust their position and then re-calibrate. After calibration the participant was then led through the slideshow observing the images each for 18 seconds, and then selecting their personal preference by looking at a number where the image used to be for the flowing 2 seconds.

4 RESULTS

Data collected from the procedure included the following: the duration spent looking at each side of the image, the number of fixations on each side of the image, the location of fixations on each image, and the side of the image the participants chose.

To determine the outcome of the study's hypotheses, analyzation of the data was performed by the implementation of a T-Test comparison between the left and right sides of each image. This was used to determine whether or not the amount of time the participants spent on each side of the image was statistically different.
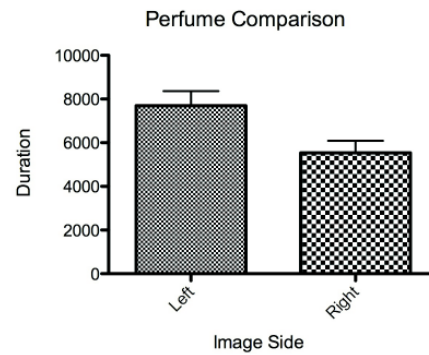

Figure 6: Comparison of the overall mean duration spent on each side of the Perfume image.

The mean duration on the left side of the perfume image in Figure 2 was 7692.6 ms with a standard error of 673.6 ms, while the right side has a mean duration of 5540.5 and a standard error of 547.7, which can be seen Figure 6. The P value for these durations was less than .0212.
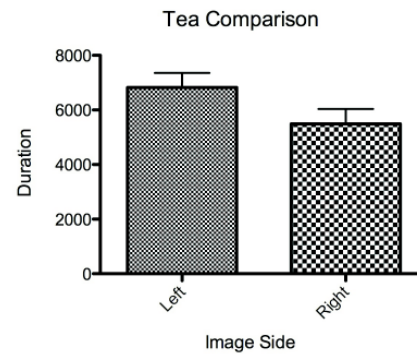

Figure 7: Comparison of the overall mean duration spent on each side of the Tea image.

The mean duration on the left side of the tea image in Figure 3 was 6825.2 ms with a standard error of 530.6 ms, while the right side has a mean duration of 5491.3 ms and a standard error of 542.7 ms, which can be seen Figure 7. The P value for these durations was less than .0415.
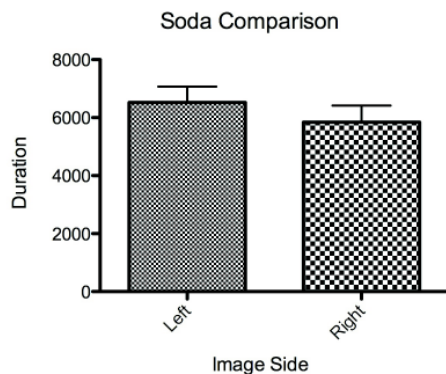
Figure 8: Comparison of the overall mean duration spent on each side of the Soda image.

The mean duration on the left side of the soda image in Figure 4 was 6520.1 ms with a standard error of 547.6 ms, while the right side has a mean duration of 5842.9 ms and a standard error of 572.5 ms, which can be seen Figure 8. The P value for these durations was less than .1990.
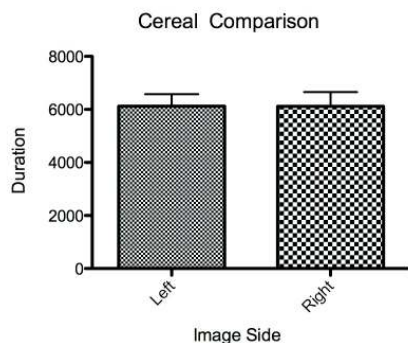

Figure 9: Comparison of the overall mean duration spent on each side of the Cereal image.

The mean duration on the left side of the cereal image in Figure 5 was 6122.7 ms with a standard error of 451.7 ms, while the right side has a mean duration of 6116.4 ms and a standard error of 543.2 ms, which can be seen Figure 9. The P value for these durations was less than .4964.

In addition to the T-Test comparison of the left and right sides of the images, a Least Squares Mean comparison with a confidence interval of α =. 05 was performed on the perfume image to determine if there was a statistical difference between where participants looked on the perfume images with the models looking straight-on or sideways. To perform these calculations, the image was broken up into 6 key areas of interest that contained the most gaze points: the eyes of the model looking straight, the eyes of the model looking to the side, the bottle next to the model looking straight, the bottle next to the model looking to the side, the logo beside the model looking straight, and the logo beside the model looking to the side. Refer to Figure 10 for an image of where the elements were located. The bounding boxes for each element were identical in size to the corresponding element in order to maintain consistency. All 6 elements were compared between

the two images, the least squares mean for each element is shown in Table 1 as well as the graph in Figure 11.
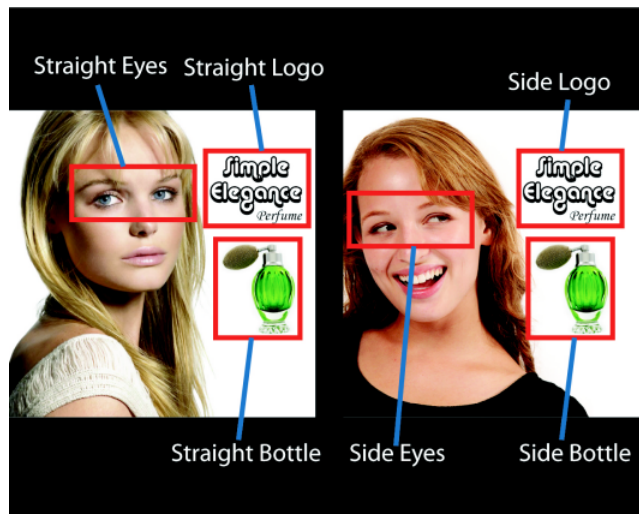

Figure 10: The 6 elements studied from the Perfume image for the Least Mean Squares.

Level			Least Sq Mean
Straight Eyes	A		3178.0000
Side Eyes		B	1854.1667
Straight Logo		B C	1175.3333
Side Logo		B C	1172.1111
Straight Bottle		C	845.0556
Side Bottle		C	729.7778

Table 1: The 6 elements studied from the Perfume image in a Least Mean Squares table.
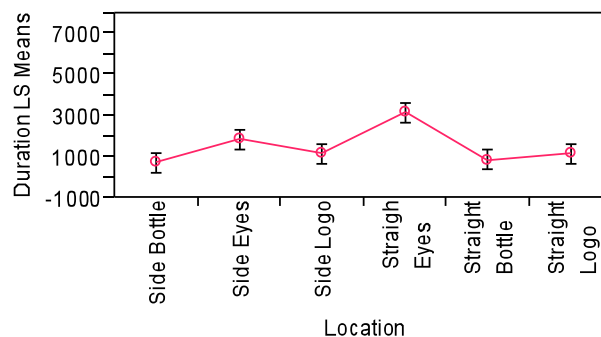

Figure 11: Comparison of the overall mean duration spent on each of the 6 elements of the Perfume image.

The data collected concerning the preferences of each participant were also analyzed to determine if they spent more time looking at the items that they picked, or on the items they did not pick. Overall, 78% of all products chosen had longer durations on that side of the image. This data was also used to determine which packaged products participants preferred most. These findings are shown in Table 2 along with the images chosen in Figures 12-15.

Image	% Chosen	Side
Perfume	78%	Eyes Looking Straight-On
Tea	83%	White and Green
Soda	78%	Logo Along Top
Cereal	78%	Apples & Berries

Table 2: Participants Preferences According to Each Image.

Figure 12: Perfume Image Chosen by 78% of Participants.

Figure 13: Tea Image Chosen by 83% of Participants.

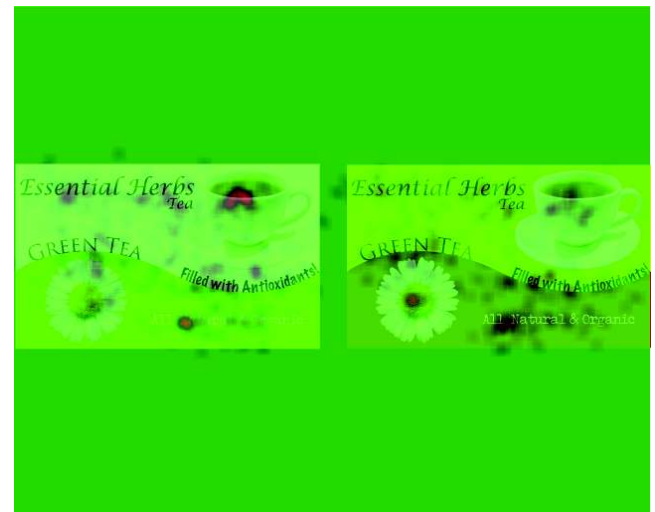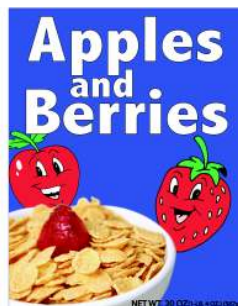**Figure 14: Soda Image Chosen by 78% of Participants.**

Figure 15: Cereal Image Chosen by 78% of Participants.

After collecting all of the eye tracking data we used the fixation coordinates to create a 'heatmap', or pictorial representation of where the majority of fixations lied on each image. In our heatmaps, locations that are green contained no fixations, while areas that are red contained many fixations.

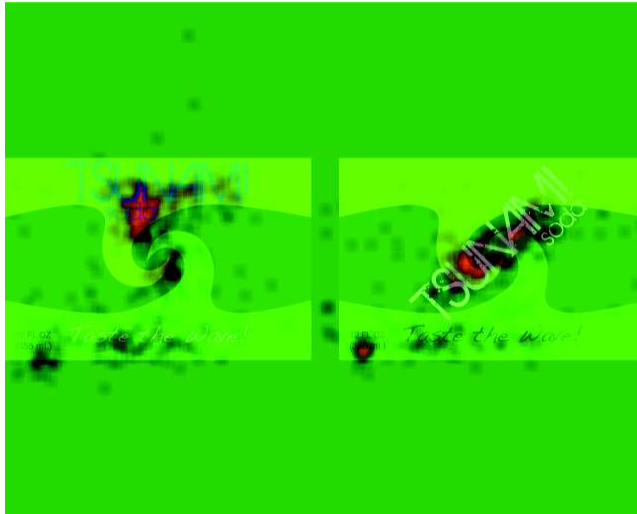These heatmaps are shown in Figures 16-19 for each image respectively.

Figure 16: Heatmap of Perfume Image.

Figure 17: Heatmap of Tea Image.
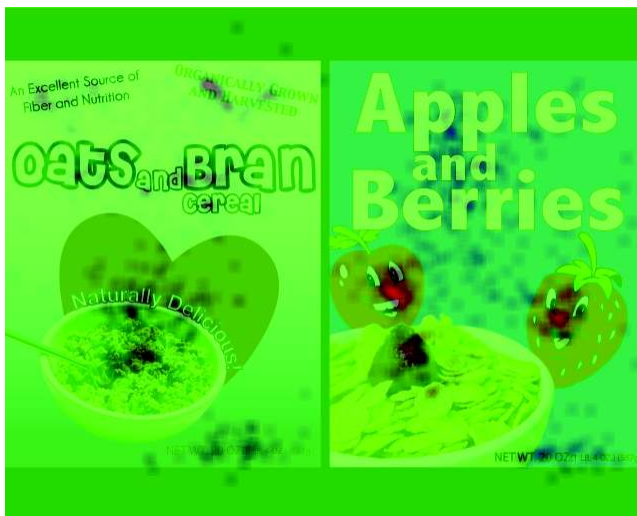
Figure 18: Heatmap of Soda Image.

Figure 19: Heatmap of Cereal Image.

5 CONCLUSIONS

The results from the T-Test determined if the duration that the participants looked at one side of the stimulus images was statistically different than when they looked at the other side. For our study, we determined that a P value of less than .05 percent probability would indicate that there was enough statistical difference to show that consumers would consider the images significantly different from one another. The results showed that for the perfume and tea stimulus images, the P value was less than .05, therefore, we were able to conclude that each image side was different than the other, and we could then draw conclusions about them. The results also indicated that for the cereal and soda images, there was not enough statistical difference to conclude that each image side was different from the other; therefore, no inferences could be drawn from these stimuli.

The results also showed that the majority of participants (78%) chose the side of the image that they looked at the longest, supporting the hypothesis that the majority of people spend more time looking at products longer due to their increased interest in them. This indicates that the ultimate sale of a product could be highly dependent upon the visual appeal of the graphics to the consumer.

Data gathered from the Least Mean Squares comparison of the Perfume elements indicated in Table 1 showed that the 'Straight Eyes' element drew more attention than any of the other elements, and that the number of fixations located there were statistically significantly different than any of the other elements. These results support our hypothesis that people spend more time looking at the eyes of a person on the package, rather than at the detailed elements of the product contained within the package. Participants were generally more interested in the eyes of the woman, more so than the name of the product or the look of the package. The packaged product with the woman looking to the side appeared to be more useful in directing people's gazes over to the logo and bottle adjacent to her, however, participants indicated that they preferred the package with the woman looking at them more. Therefore this brings about an interesting situation; should a designer use a model looking straight on to attract and hold people's attention and eventually make a sale due to the longer amount of time spent looking at the package, or should they design using a model looking to the side in order to get people to gaze at the brand name and logo of the company to ensure that customers realize who made the product.

Further information on this subject was gained from looking at the heatmaps of the fixations on each image. The image of in Figure 16 with the Perfume shows how much participants looked at the women's eyes. Similarly, in Figure 19 with the Cereal box images, showed how participants looked at the faces of the graphic characters more than any other elements of the package. This indicates that we as humans are not only drawn to faces and eyes of other humans, but we are also drawn to the faces and eyes of fictional characters as well.

Another finding of this study was that many people showed preference to the green and white tea package, versus the yellow and red by 83% overall. This supports our hypothesis that most customers have expectations of certain colors associated with particular packaged products. Meaning that it is beneficial for companies to determine what colors have the largest amount of appeal to consumers based on what they are looking for and making an attempt to cater to their appeals.

6 REFERENCES

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