Pharmaceutical Packaging: Placement of Active Ingredient and Expiration Date on OTC medicine

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INTRODUCTION

The goal of the paper is to analyze the eye movements on a pharmaceutical package with respect to its package design. We test the usability and readability of important active ingredient and expiration date information present on the package. Experiments are conducted to study how positioning of a specific information on the package influences its findability. Previous studies include the usability decisions taken to improve the label design in pharmaceutical packaging. The eye tracking study is based upon the hypotheses that placing the expiration date on the front of the package and placing the active ingredient on top left corner of the front of the package is more efficient while buying over the counter medicine package. The results are determined based upon the metrics such as Time to First Glance and Glance Duration.

BACKGROUND

In the current market of pharmaceutical packaging, there are many different label designs and package sizes. Walk into any drug store and, as an observer, you are immediately inundated with various colors, sizes, fonts, and graphics. Our study was conceived in the interest of determining if the inconsistencies in information placement affect the users ability to locate pertinent information such as expiration date and the active ingredient. More specifically, to discover if changing placement of such specific information will help decrease the time it takes to locate the information on the pharmaceutical package.

Bojko et. al.[1] evaluated drug label design specific to pharmacy dispensary- looking at how the eye scans from package to package as well as the eye movements within the label design. The team standardized the labels and conducted usability studies where they asked participants to locate the relevant information. Overall, the new, standardized labels showed a lower time to first fixation when searching for the pertinent information [1]. Included in the differences in pharmaceutical packaging is the use of different texts, such as sizes, font types, and styles.

Visual search for information can be affected by the design layout of text. On the current market there are intermixed fonts and serifs, creating discord in packaging aesthetics. Furthermore, it makes locating information harder for the user. Halverson et. al.[3] studied how design layout of text can affect a users visual search for information by testing participants on their ability to locate a key word within varying densities of text blocks. They concluded that users spent less time per work while searching through sparse layouts and also that users generally will not search dense word groups first [3]. As well as searching for text, consumers are swayed by text alignment. Traditionally, consumers are more drawn to right aligned text and rounder objects [5].

Another consideration for packaging is shelf environment. The surrounding products can often lead to visual contamination for the consumer [4]. In a pharmaceutical retail environment, this can be detrimental for the consumer looking for a specific active ingredient, making the placement even more important for easy access to information. As well as placement consideration, the concept of brand loyalty must be taken into account. Some shoppers are more drawn to a name brand product that they are familiar with versus a comparable generic product that they have no previous affiliation towards [2].

Within the world of packaging, the design affects user ability, whether positively or negatively. In the world of pharmaceutical packaging these issues still exist between fonts, colors, and graphics. Researchers and designers alike continue to strive for consistency in design in order to create user-friendly packages and make information more readily available.

HYPOTHESIS

The following hypotheses were developed prior to conducting the experiment.

H1: When handed an over the counter medicine package with the side panel facing the participant, subjects will be able to find the expiration date quicker when it is located on the front of the package.

H2: When handed an over the counter medicine package

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Figure 1. Package A

with the side panel facing the participant, subjects will be able to find the active ingredient quicker when it is located in the top left corner of the front of the package.

METHODOLOGY

The experiment was conducted in the McAdams Eye Tracking Lab at Clemson University. The Dikablis Eye Tracking head unit was used for the experiment to track the participants gaze data. The metrics tested was time to first glance. The researcher also manually recorded the time it took the participant to complete each task. A survey was given following the study to provide demographic information and other study related questions.

Participants

The participants used in the study were randomly selected Clemson University students and faculty. There was a total of 20 participants. Most of the participants were from the Computer Science 612 class. Others were randomly selected on Clemsons campus. No incentive was given to the participants for completing the study.

Stimulus

Four original package designs were created for this study. The package design simulates an over the counter pain medication package. The original brand, SADVIL, was used instead of a well-known brand so that participants were not swayed by brand loyalty. The siz" of each of the boxes is $6'' \times 6'' \times 4''$. A Dikablis tile marker was placed on the front, back, and two sides of each box in order to get the gaze data. The top and bottom of each box consisted of one solid color and no tile marker was needed. The design was created using the Adobe Illustrator and Esko Artisocad programs. The graphics were printed on the Roland UV-Versa printer and the boxes were cut out on the Kongsberg Multicut machine. The main design remained the same across all four, the placement of the active ingredient and expiration date varied:

Figure 2. Package B

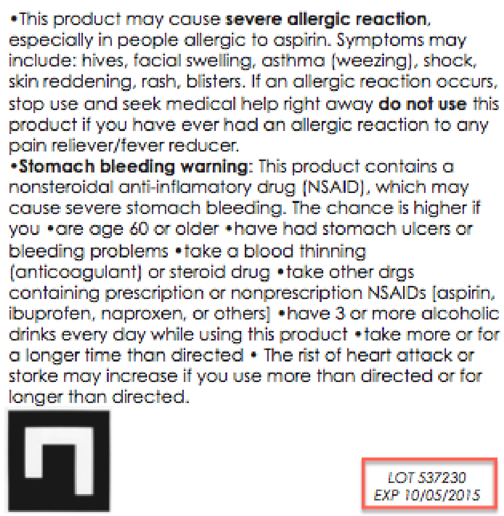

Figure 3. Package C

Figure 4. Package D

	Expiration Date	Active Ingredient
Position	Front (Package A)	Top Right (Package B)
Position	Back (Package C)	Bottom Left (Package D)

Figure 5. MIxed Factorial Design(Variables: A,B,C,D)

Package A: Expiration date placed on the front of the package. Package B: Active ingredient placed on the front in the top left corner. Package C: Expiration date placed on the back of the package. Package D: Active ingredient placed on the front in the bottom right corner. (See Figures 1-4)

NOTE: The red rectangle indicates the location of the variable but is not actually printed on the package.

Apparatus

The stimuli were presented as two boxes of sizes $6'' \times 6'' \times 4''$. The eye movements were detected using the gaze analytic head-mounted eye tracker, Dikablis with eye cameras for each eye and a field camera in the front as shown in Figure 6. The eye tracking camera has a resolution of 384×288 pixels,PAL , 25fps. The field camera records a high-resolution color video of the test persons visible area at a resolution of 768×576 pixels, PAL, 25 fps.

Experimental Design

A 2×2 mixed factorial research design was used in the study (See Figure 5). Within this design both between and within subject variables were used. All subjects were given a box containing an expiration date and another box containing the active ingredient. However, each subject only saw one position of the expiration date and one position of the active ingredient. Each variable was seen the same amount of times but the order was randomized among subjects. Half of the subjects were asked to find the active ingredient first, while the other half were asked to find the expiration date first. The researchers created a document prior to the study listing exactly what order each participant was to receive each box.

Figure 6. Dikablis Head-Gear

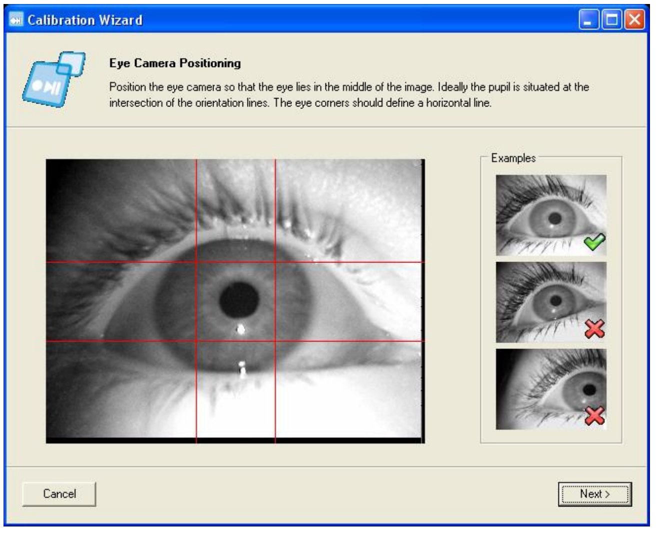

Figure 7. Adjusting the Eye-Camera

Procedure

Subjects were asked to participate in a 10 minute research study. The study consisted of four steps: calibration, two tasks, and a short survey. Prior to beginning the study, participants were informed of the process and were shown applicable IRB forms. They were also given the opportunity to ask questions.

Step 1: Calibration

The Dikablis has to be calibrated for each participant separately. The subject was asked to wear the eye gear and hold a sample box, that is the same size as the stimulus, but with no design on it. Instead it has a Marker in the middle. The calibration wizard is started. First, we adjust the left eye camera so that, the pupil is in the middle of the grid, as shown in Figure 7. We adjust the sensitivity of the instrument to optimize the pupil detection (See Figure 8). The instrument needs to be calibrated such that it can detect gazes on a particular hy-

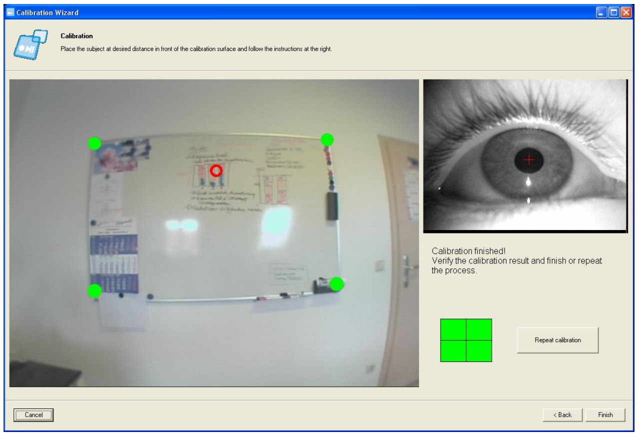

Figure 8. Calibration

perplane. To do this, the participants were asked to hold the sample stimulus look-alike. As the participants looked at the four corners of the box, one at a time, the calibration wizard highlights the corresponding quadrant on the hyperplane that needs to be clicked on (See Figure 9). To test the accuracy of the calibration, the participants were asked to trace the tip of a marker.

Step 2: Task 1 Active Ingredient

The participants were asked to find the active ingredient. The researcher instructed them of this prior to handing them the box. They were told to alert the researcher when they found the active ingredient by reading it aloud. As soon as the box was placed in the participants hands, the researcher started a timer. Once they began to read it out loud, the timer was stopped.

Step 3: Task 2 Expiration Date

The participants were asked to find the expiration date. The researched instructed them of this prior to handing them the box. They were told to alert the researcher when they found the expiration date by reading it aloud. As soon as the box was placed in the participants hands, the researcher started a timer. Once they began to read it out loud, the timer was stopped.

Step 4: Survey

Once the tasks were completed, the headpiece was removed and the participants were asked to complete a short survey including basic demographics and study related questions.

Note: Steps 2 and 3 were completed in reverse order for half of the participants

DATA ANALYSIS

The manual recording data and the data from the D-lab software were imported into the statistical analysis program, SPSS. Four different independent sample t-tests were performed to see if the data had significant differences in the placement

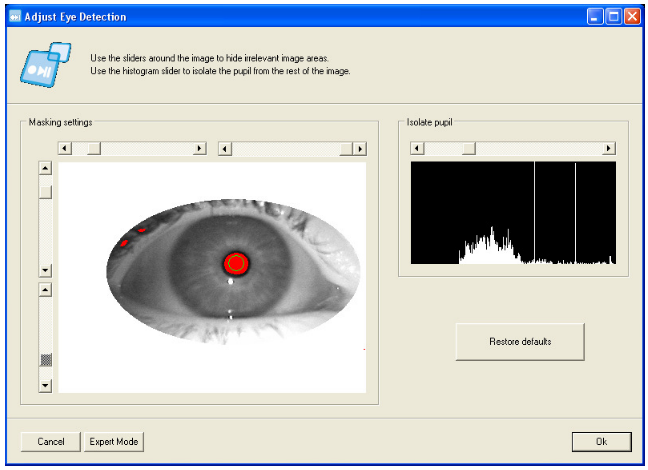

Figure 9. Pupil Detection Configuration

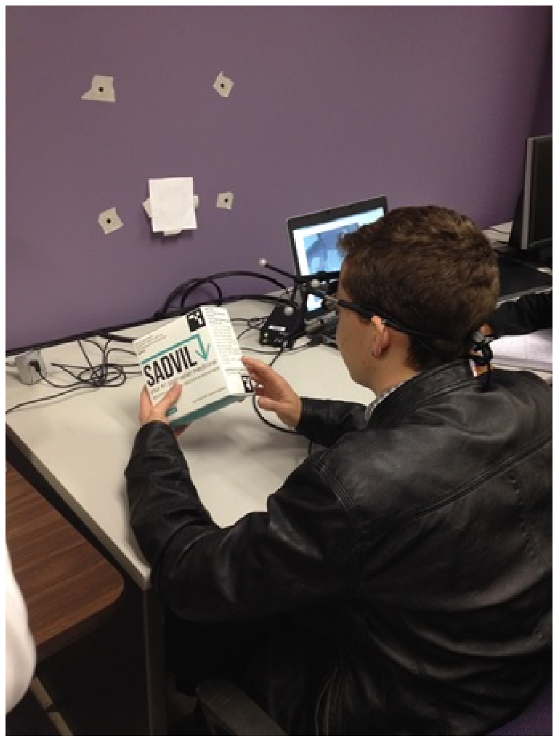

Figure 10. Participant completing the experiment in the eye tracking lab.

of the expiration date and active ingredient. The metric of interest for the D-lab software was time to first glace (in seconds), while the manual recording data was time to verbal confirmation of task completion (in seconds). Time to first glance (TTFG) was defined as the time, in seconds, that it took the participant to fixate of the area of interest (active ingredient or expiration date). Four independent sample t-tests were also conducted to see if the manual recording times differed significantly from the eye trackers recording for time to first glance for each of the tasks. An alpha value of .05 was used in the analysis of the t-tests.

RESULTS AND DISCUSSION

1. Expiration Date: Front vs. Back

After running the independent sample t-test for TTFG from the D-lab software, it was determined that there were no significant statistical differences in the placement of the expiration date (p-value = 0.559, $0.559 > 0.05$). When handed a pharmaceutical package with the side panel facing out, the placement of the expiration date does not affect the consumers time to fixate on it.

Another independent sample t-test was conducted for the manual recordings of time to task completion. This test also proved that there are no significant statistical differences in placement (p-value=0.389, $0.389 > 0.05$). As expected based on the t-test for TTFG, the placement of the expiration date does not affect the consumers time to locate it.

Figure 11 shows the mean times for manual task completion and time to first glance. The graph also demonstrates that the there are no significant differences in the placement of expiration date.

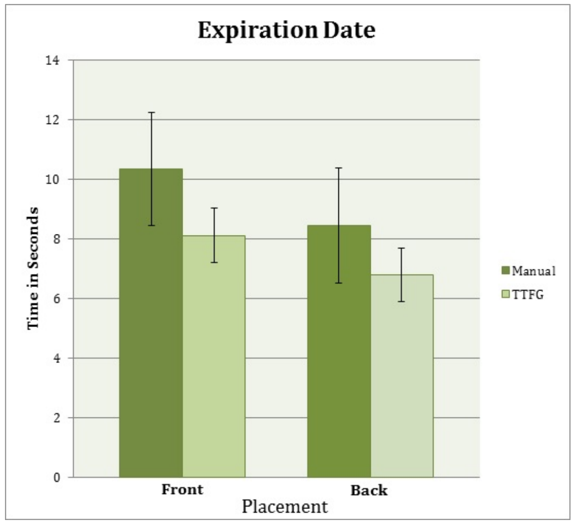

Figure 11. Means of manual time to task completion and TTFG for the placement of expiration date (with error bars)

2. Active Ingredient: Bottom Right vs. Top Left

An independent sample t-test for TTFG from the D-lab software was performed. It was determined that there were no significant statistical differences in the placement of the active ingredient (p-value = 0.929, $0.929 > 0.05$). The placement of the active ingredient on the front panel, whether top left or bottom right, had no impact on how quickly participants fixated on it.

A t-test was also conducted for the manual recording data for the active ingredient task completion. The data also proved to have no statistical significance (p-value=0.809, $0.809 > 0.05$). This means that the location of the active ingredient did not affect the time it took the participant to find it.

Figure 12 shows the mean times for manual task completion and TTFG for the active ingredient. The graph shows that there is no significance. The error bars in the graph are extremely large compared to the expiration date graph. This could be due to a possible outlier in the data.

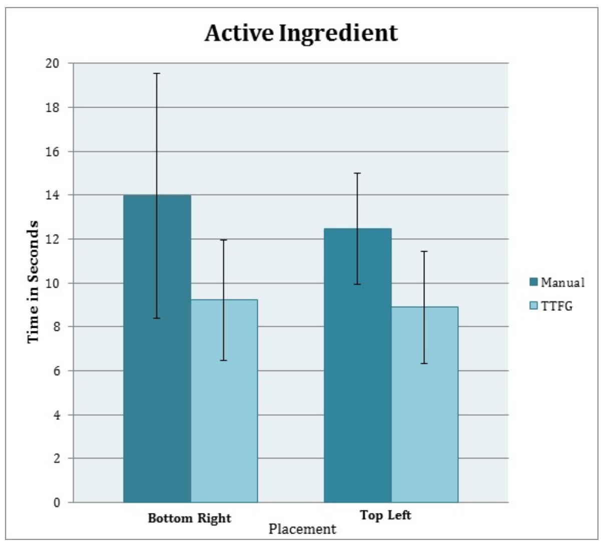

Figure 12. Means of manual time to task completion and TTFG for the placement of active ingredient on the front panel of the package (with error bars)

Note: For failed video recordings and participants who were unable to complete the task, the mean was used for their TTFG and time to task completion.

Four independent sample t-tests we run to see if there were any differences in the manual data vs. the D-lab software data (TTFG) for each of the tasks. Each of the tests proved that were no statistical differences in the manual data and software data.

According to the survey, 90% of participants buy over the counter medicine at least once a year. 68% typically buy generic OTC medicine rather than name brand medicine. About 48% of participants look for the active ingredient before purchasing OTC medicine, while 60% of participants look for the expiration date before purchasing.

These results can be useful in pharmaceutical packaging applications. The package designers do not need to place the expiration date or active ingredient in a specific location for consumers to find it quicker. However, it is important for package designers to understand that while the location of the active ingredient and expiration date may not be important, it is important to make them easy to locate since a majority of people look for these before purchasing the medicine.

One limitation of this study that could have possibly affected the results was that the study took place in an eye-tracking lab instead of a realistic shopping environment. The packages were handed to each participant with the side panel facing towards them; therefore it took the same amount of time to turn to the front or back panels. In a real drug store, the front panel of the package would be the first thing the consumer sees. This could be fixed by testing packaging in a more realistic shopping environment and using a mobile eye tracker.

CONCLUSION

Pharmaceutical packaging must relate information to the consumer in the most effective way possible. Two main components, active ingredient and date of expiration, play a large role in the design of a box. The timed eye tracking study was preformed to determine if a consumer could locate these two descriptors. There were no significant differences in where the information was places (top left, bottom right, front or back). The results were determined by analyzing time to first glance and glance duration. The study was conducted in a lab, not a realistic drugstore environment, which could have contributed to the results seen here.

Overall, pharmaceutical packaging still requires clarity of information for the consumer. Much research has been conducted to determine the best placement for information on packaging as well as how product placement on a shelf affects a purchase decision. To further the research conducted here, the experiment could be reworked and run in a more realistic pharmacy environment. Also, expanding the participant pool would be beneficial in future experiments.

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