

COMPARISON OF WARNING LABELS ON PLASTIC BAGS

Tammy Lynn, Montana Tech
Roger Jensen, Montana Tech

tjlynn@mtech.edu

ABSTRACT

Most plastic bags in our society contain a warning about the suffocation hazard, yet the U.S. Consumer Product Safety Commission still receives approximately 25 reports annually describing deaths of children who suffocated due to plastic bags.

This study examined three of the warning features on plastic bags: (1) border versus no border, (2) position of the signal word relative to the text, and (3) all capital letters versus sentence case. Ratings provided by more than fifty students indicated highly significant effects of the border on noticeability, and position and letter case on reading likelihood. Strongest effects were from presence of a border and positioning the signal word centered over the text message.

INTRODUCTION

“The U.S. Consumer Product Safety Commission (CPSC) still receives an average of about twenty-five reports a year describing deaths to children who suffocated due to incidences involving plastic bags.” Almost ninety percent of those cases involve children less than one year of age. This indicates that the suffocation hazard is not adequately being conveyed to the parents and caregivers. “Recent reports often describe bags originally used for dry cleaning and storage as the cause of suffocation death to infants. Some may have been used to protect bedding and furniture, and others were just not carefully discarded.” (CPSC, 2005) This statement by the CPSC indicated a need for further investigation into suffocation case history. A few studies have examined the cases of asphyxiation of children and infants. The following paragraphs summarize the literature.

Background

Asphyxia by smothering is due to any circumstance that prevents breathing by obstructing the nose and mouth (Polson, 1985). It is a simple and not uncommon mode of infanticide and accidental death in infants (Suzuki, 1992). This method of asphyxiation is referred to as oronasal obstruction (Drago, 1999). In the past, although not extremely common, cases have been described in which plastic bags have been deliberately placed over the heads of young children and in less common cases over the heads of adults (Sturner, 1976). This paper, however, deals mainly with the unintentional suffocation of infants and young children.

The dangers associated with plastic bags were recognized as early as the 1950's. Around this time it was found that plastic bags originally from the dry cleaning industry were being used in infant beds beneath the sheets for waterproofing purposes and were the primary cause of death for a number of infants (Drago, 1999). There are two dangers associated with plastic bags: (1) it adheres to the nose and mouth region, partly due to the inhaling process and partly due to the static electricity effect that plastic bags exhibit; and (2) it is strong enough that, in their limited abilities, infants cannot tear it away. Since it takes only a few short minutes for damage or death to occur due to lack of oxygen, intervention needs to take place so that the infant is not placed in a situation where there is a possibility of coming into contact with plastic bags at all.

“In the late 1950's the Society of the Plastic Industry, Inc. sponsored an intensive nation-wide educational program to inform the public that the ultra-thin plastic bags, particularly the type used by dry cleaners, were made for one-time use only and should not be reused in ways that might present a hazard to children” (SPI, 2000). Though this was a step in the right direction, the instruction here was vague at best. The positive facet was that many different organizations, including the US Department of Health, Education, and Welfare (now known as the Department of Health and Human Services), the Academy of Pediatrics, the National Safety Council and others were brought together in a combined effort (Drago, 1999).

In the 1960's plastic bags were again in the spotlight. This time questions began to be raised about the warning labels on plastic bags after the bags were linked to more cases of suffocation deaths of young children. In these cases, as in those from the 1950's, deaths occurred when the bags were used for purposes that had become common but were not among intended uses. The SPI continued to issue periodic bulletins to those in the industry reminding of the importance of continuing with the warning label activities, but at this time there were no new responses to dealing with the problem. Although the SPI has continued to issue these bulletins periodically through the years the content has not changed much since 1982 and even still refers to the tragic incidents that occurred in the 1950's and 60's (FBF, 2005).

Today plastic bags continue to be an issue. “In western countries, the leading causes of mortality during childhood are accidents, the most frequent being traffic accidents, intoxications, burns, and mechanical asphyxias” (Calvet, 1992). The first three items in this list are often the subject of scientific studies, research, and educational discussion, yet little has been done with the knowledge that plastic bags are often the agent in mechanical asphyxia of infants and children.

In a study conducted by Drago and Dannenberg (1999), various cases and related information relevant to mechanical asphyxiation were examined over a 17-year period. It was found the most frequent cases of suffocation were wedging between a bed or mattress and a wall, and oronasal obstruction by plastic bag. The study also discovered that when three frames within the period of 1980 to 1995 was investigated, an increase for overlain and oronasal obstruction was shown in all three. This suggests that the warning/hazard information at this time was either inadequate or failing in some way to capture the attention of the intended audience. After the initial study, a follow-up was conducted of 38 cases. In the follow-up it was found that 2 of the cases were caused by oronasal obstruction, and in both cases it was due to the infant falling off a bed onto a plastic bag filled with cloths (Drago, 1999). It appears that although the causes of death in the Drago/Dannenberg cases were slightly different from those in the 1950's and 1960's, plastic

bags were still posing a danger to the young. They noted that oronasal obstruction was the second leading cause of suffocation death in infants. The highest danger was for the age group from birth to less than 3 months and 3 months to less than 7 months of age. These groups made up 80% of the cases. “Up to 2-month-olds exhibit largely reflexive actions, whereas 3- to 6-month olds, are relatively more developed, display more oral and manual exploratory behavior and more motor ability” (Drago, 1999). The abilities of the infants may play a large role in the most highly affected age groups due to the fact that younger infants and children lack the physical ability to tear the plastic away or to remove themselves from the situation.

Current Approach to Warnings

Warning labels are now found on thousands of products. This has resulted mainly from the concerns that manufacturers have for user safety, fear of litigation, legal requirements, and industry standards (Cox, 1997). A voluntary consensus standard on product warnings is available (ANSI Z535 Committee on Safety Signs and Colors, 2002), but not used for any of the numerous bags collected by the authors. Additionally, we found no national regulations or standards specifically for the warning labels found on plastic bags.

Some jurisdictions have instituted local requirements. “Presently, the cities of Chicago and New York, and the states of California, New York, Virginia, Massachusetts, and Rhode Island require warning labels on certain plastics bags” (FBF, 2005). For these jurisdictions, the requirements are for plastic bags that have a thickness of less than 1mil (1/1000inch) and have an opening size of seven inches or more (5 inches in Rhode Island).

In New York and Chicago, as well as in the states of New York, Massachusetts, Virginia, and Rhode Island the following or similar warning statement is also required:

Warning: Keep this bag away from babies and children. Do not use in cribs, beds, carriages or playpens. The thin film may cling to nose and mouth and prevent breathing.

The state and city regulations also specify size of font relative to the size of the bag (FBF, 2005). These jurisdictions have recognized the need for appropriate labeling. Unfortunately, their requirements do not mention the ANSI standard or encourage bag manufacturers to follow it.

According to Cox (1997), “One major insurance carrier indicated that 44% of all lawsuits in the United States involved an inadequate or non-existent warning.” Since lawsuits translate in to a bottom line issue, the statistic of 44% should be of extreme concern for industry. Cox shared the following rationale for product warnings.

An effective free market system requires that consumers be enabled to make informed product purchase and usage decisions. Product warnings are an especially important information source designed to protect consumers and their property from physical harm. Warnings provide a proactive public policy alternative to reliance on the tort-liability system for the redress of consumer

grievances or government intervention in which the ultimate action could be to recall or ban a product (Cox, 1997).

To date, warnings and instructions have been considered in a rather simplistic fashion whether for products, processes, or services. The highly respected lawyer and attorney George Peters commented on product warnings: “They have been relegated to a secondary position in the activities of design engineers and others who can directly effect health, safety, and environmental matters” (Peters, 1999). Ironically, a substantial body of research provides considerable information about features of warnings that enhance noticeability, comprehension, and behavioral intent (Miller, 2001). However, legislators, regulators, and lawyers rarely incorporate this research into product warning requirements. For example, regulations for warnings on alcohol bottles and charcoal bags simply dictate a text message without any requirement for a format that would increase noticeability. Cox (1997) observed that “...government mandated warnings are typically developed through administrative or legislative processes without the aid of empirical testing.”

This is important to the industry and manufacturers because the use of empirical testing could help to improve warning labels and thus improve their effectiveness. Stewart (1994) observed “warning effectiveness is determined by characteristics of (1) the warning (2) the product (3) the usage situation and (4) the user.” This means that the interaction of these characteristics must be investigated and the results implemented to protect those involved in the plastic bag industry. The use of empirical testing is important in that it shows that the manufacturer has made every effort to design an effective warning label for their product and if there were to ever be a lawsuit, it would help to show that they were diligent, not negligent, in their product development and marketing. This project was undertaken to provide empirical testing of selected features of the warnings for plastic bags.

Purpose

The purpose of this study was to examine some of the features related to the labels to determine their effectiveness. A collection of samples taken previous to and during the study revealed little uniformity or standardization of these warning labels. There are a variety of features to warning labels including color, word placement, and font size. The following three features were selected for this project: (1) border versus no border, (2) the position of the signal word relative to the text, and (3) all capital letters versus sentence case. In the samples collected, most often all capital letters were used even though the ANSI Standard specifies sentence case for the text message.

The first step in the project was to develop a testing method. This began with two important questions: (1) How could the data be obtained, and (2) How would it be analyzed once collected? To get a method that was both analyzable and scientifically sound, research on testing methods was examined. For this stage of the project, the book “Warnings & Safety Instructions 4th Edition” by Miller and Lehto (2001) proved a primary source for locating previous studies. Prior studies at Montana Tech were also useful for determining sample size and procedures. These sources indicated that college students provide an appropriate population for testing features of warnings. (Thomas and Jensen, 2004).

METHODS

Study Design

The study was designed to test specific hypotheses. The first hypothesis concerned noticeability of the border warning versus a no border warning using the null hypothesis of no difference, versus the alternate hypothesis that the framed warning is more noticeable. Each survey booklet had three pages, each containing a pair of identical warnings except one was framed. Subjects rated which was most noticeable. Responses were coded by assigning +1 to responses indicating the frame was more noticeable, 0 for no difference, and -1 for the unframed warning being more noticeable. This hypothesis was tested using a one sample sign test to determine if the median was greater than zero.

The second hypothesis addressed effects of the signal word placement on likelihood of reading. The null hypothesis was no effect of the three placements on ratings. The alternate hypothesis was at least one placement had an effect. A randomized block experimental design was used to provide data for this test. The same experimental design provided data for testing effects of using all capital versus sentence case in the text message.

Prior studies at Montana Tech indicated that a sample of 50 subjects was adequate for testing similar features of warning signs (McCammack, 2002; Thomas, 2004).

Pages of the booklet were constructed to clearly contrast the different issues. Three pages contained a pair of identically formatted warnings except one had a rectangular border. An example pair is in the top of Figure 1. Both exemplify sentence case text with the signal word placement left of the text message. Subjects were asked to indicate which was most noticeable, or if they were equally noticeable. A set of six pages contained pairs of text warnings with different placements of the signal word and different use of font in the message (all caps versus sentence case). The six pages contained the combinations of three placements and two cases. Examples of two warnings with different placements are on the lower part of Figure 1. These illustrate the all caps text with the signal word placements imbedded and centered above the text, respectively. Below the warning was a question with a response scale. The question was “If you saw this label on a plastic bag, how likely would you be to read it?” The response used an ordered, equal-interval scale with words only (no numbers). The scale, with numbers assigned for analysis, was:

- 0 Never
- 1 Unlikely
- 2 Likely
- 3 Very Likely
- 4 Extremely Likely

The booklets were designed so that approximately one half the pages had the bordered warning in the higher position on the page. The tests were conducted by entering the collected data and using Minitab version 14 software to analyze it.

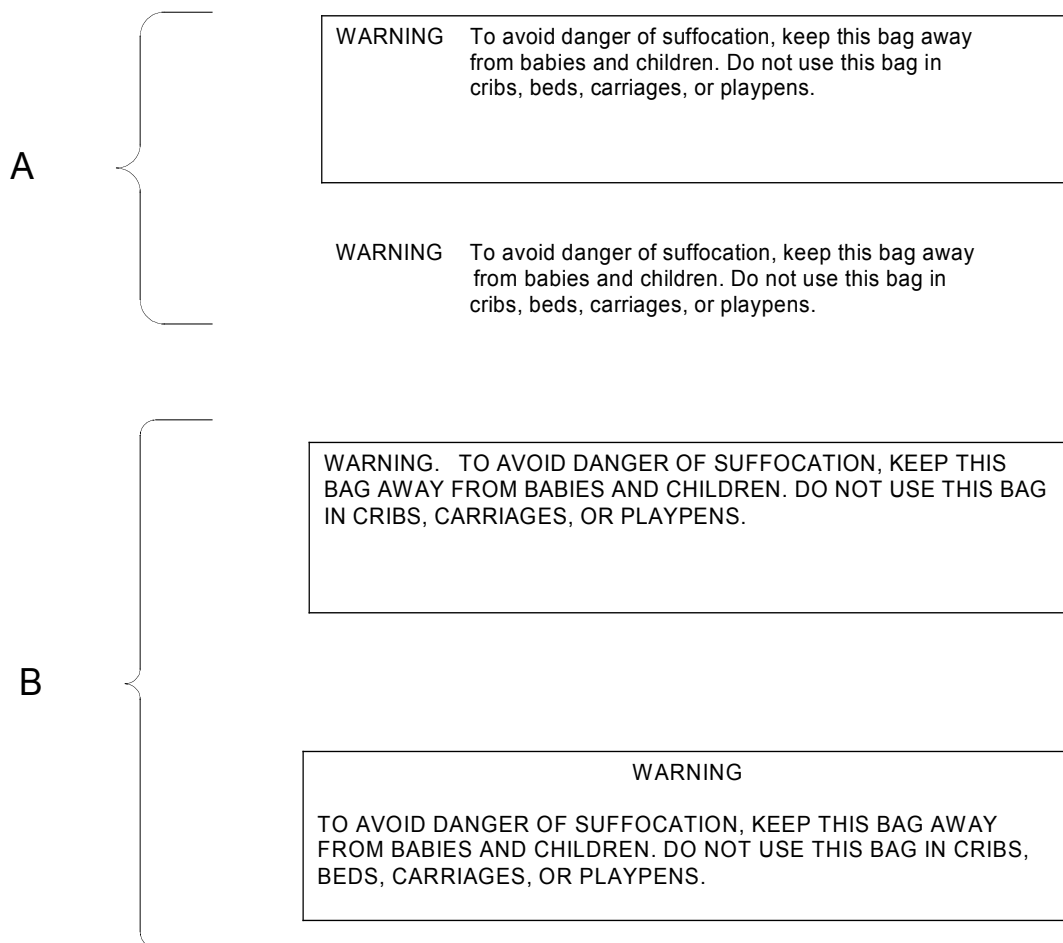


Figure 1. Illustration of warnings in the test booklet. The two at the top (A) were paired to contrast border versus no border for noticeability. The two at the bottom (B) were individual pages with the rating scale for reading likelihood.

Procedures

The actual testing took place in Montana Tech classrooms. After explaining the purpose and procedures, subjects were administered a survey booklet with a cover page. It took approximately 10 minutes to complete the survey. Subjects were given five dollars after completing the survey.

Subjects

The subjects in this study were all Montana Tech students ranging in age from 18 to 52 with a mean of 23.8 and median of 21. There were no faculty members or staff included among the subjects. The use of human subjects was approved by the University of Montana Human Use Committee prior to the start of this project.

Females constituted one-third (19 of 57) of the participants. A previous study found that Montana Tech students provide ratings of warning signs very similar to students at the University of Georgia and to a sample of employed persons in Montana (Thomas and Jensen,

2004). For this study, student participation was obtained by asking three instructors for permission to conduct the survey during one of their normal class session. The selected classes were Construction Safety, Human Sexuality, and Senior Engineering Design. This allowed for a variety of students, both safety and non-safety oriented.

RESULTS

The 57 subjects provided three ratings each of the bordered versus no border warnings with one point missing. Thus, there were 170 ratings. The warnings with a border were rated significantly more noticeable ($p < 0.0000$, median = 1). Of the 170 responses, 159 chose the bordered warning, 3 rated the border and non-border equally, and 8 felt that the non-bordered warning was more noticeable.

The data that compared signal word placement and sentence case were analyzed initially using the nonparametric Friedman Test. It indicated the six pages significantly affected ratings ($N = 53$; $p < 0.000$). Results are shown in Table 1. The two warnings with the signal word centered about the message rated highest. Those with the signal word to the left rated second highest, and those with the signal word imbedded in the paragraph rated lowest.

Table 1. Warning formats in order of sum of ranks

Page	Signal Placement	Word Case	of Message	Estimated Median	Sum of Ranks
P5	Centered Above	ALL CAPS	Sentence	2.0000	239.0
P2	Centered Above	ALL CAPS	Sentence	2.0000	229.5
P3	Left	ALL CAPS	Sentence	1.6667	211.5
P1	Left	ALL CAPS	Sentence	1.6667	168.0
P6	Imbedded	ALL CAPS	Sentence	1.1667	147.0
P4	Imbedded	ALL CAPS	Sentence	1.0000	118.0

This analysis also revealed that the influence of using all-caps case for the message appeared to have a smaller effect than placement of the signal word. For the highest rated format (centered above) the influence was clearly not significant. But for the lower rated formats (left and imbedded) the all caps warnings received somewhat higher ratings than the sentence case messages.

After finding significant treatment effects for the pages using the Friedman Test, ANOVA was used to examine more specific effects. This was accomplished by testing the statistical model

$$R = \mu + P + C + S + \varepsilon , \tag{1}$$

where R is rating, μ is grand mean, P is effect of placement of the signal word, C is effect of case of text message, S is effect of subject, and ε is the residual error term.

Results are in Table 2 for all subjects who provided ratings for all items. It shows all three independent variables significantly affected the ratings of reading likelihood. The strongest effect was clearly placement of the signal word. Text case and subjects also had very significant effects. The model accounted for 40.7% of the variance (R^2 adjusted).

Table 2. Results of ANOVA

Source	DF	SS	MS	F	P
Placement	2	49.15	20.08	64.8	0.000
Case	1	4.08	4.08	13.2	0.000
Subject	52	69.80	1.34	4.3	0.000
Error	262	81.11	0.31		
Total	317	195.13			

CONCLUSION AND DISCUSSION

This study looked at three features as they relate to the overall effectiveness of plastic bag warnings. The information gathered on border versus no border strongly indicated that there is indeed more noticeability when a border is placed around the text. This study also indicated that placement of the signal word strongly affects the ratings of reading likelihood. Using all capital letters in the text message helped; however, reading likelihood is not the only issue. Readability is better with sentence case. It appears preferable to use sentence case in the message in order to enhance readability and use other features to capture attention.

The suffocation hazard of plastic bags continues to be under appreciated by parents and caregivers. This is evident from the continued deaths of infants and young children. One way to increase caregiver recognition and appreciation of the hazard is to increase the noticeability of the warnings on the bags. More effective warnings would help draw attention to the hazard. Awareness of the hazard would empower caregivers to take appropriate precautions to save lives.

One option for improving the warnings would be to implement the ANSI product warning standard. We anticipate some objection from the industry due to the cost of retooling to make multicolored warnings. However, that investment may lead to reducing the number of deaths and the many costs associated with litigation. Another option would be to implement simple changes in format using a single color. Results from this study showed that simply printing a frame around the warning significantly improves noticeability. Centering the signal word above the text increases reading likelihood. Although we recognize several issues for further research, we see no reason why implementing these simple improvements needs to wait for further studies.

There are several issues for further research. Perhaps the most important is to develop a pictogram depicting the suffocation hazard. A pictogram would have the advantages of transcending languages, communicating with caregivers having limited reading ability, and providing quick reminders for those already familiar with the hazard.

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