

Lim, R. W., & Wogalter, M. S. (2006). Perceived effectiveness of bilingual label designs by English and Spanish language users. In R. N. Pikkari, E. A. P. Koningsveld, & P. J. M. Settels (Eds.), *Proceedings of the XVIth Triennial International Ergonomics Association* (pp. 6541–6546). Amsterdam: Elsevier (ISSN 0003–6870).

Perceived effectiveness of bilingual label designs by English and Spanish language users

Raymond W. Lim and Michael S. Wogalter

North Carolina State University, Raleigh, NC, 27695-7801 USA

Abstract

According to the U.S. Census Bureau, Hispanics are now the largest minority group in the U.S. Because many of these immigrants know little or no English, they are at a greater risk of injury because most product warning systems in the U.S. are exclusively in English. This study examined the perceptions and performance of both English and Spanish language users for various formats of bilingual labels (labels with two languages). English and Spanish language users gave ratings of acceptability, likelihood of purchasing product, and the likelihood of reading to each of a set of systematically-manipulated bilingual label designs on actual box and cylinder shaped containers. In general, designs having both languages arranged horizontally (side-by-side) were given higher ratings than vertically (top and bottom). English users strongly preferred labels with English in the primary position (e.g., left side, top side); whereas Spanish language users held less strong beliefs about their language in the primary position. The design with English-text on the left half and the Spanish-text on the right half on the box was the most preferred by both English and Spanish language users in the set tested. The box container labels were rated higher than those on the cylinder. The results suggest that bilingual labels are not only viewed favorably by users of the benefited minority language, but also by users of the majority language.

Keywords: Label designs, consumer product safety, risk perception, bilingual warnings, warnings

1. Introduction

The U.S. Census Bureau projects an increase in Hispanics from 11.5% to 15.8% of the total U.S. population from 1999 to 2015 [1]. As of July 2001, the Census Bureau reported that Hispanics to be the largest minority in the U.S., comprising 13% of the total U.S. population, surpassing African-Americans (12%) [1].

A large proportion of the new Hispanic immigrants frequently use Spanish and not English in their daily routine. To potentially accommodate for this, labels on products may incorporate two languages. However, English language users may not be too accepting of the Spanish language on

products sold in the U.S. But a previous research examined this issue and the results indicated that English language users were accepting of bilingual labels in the U.S. [2].

Moreover, while the addition of a bilingual language could enhance safety for users of the Spanish language, because information communication is enhanced by adding their language, it may have disadvantages to users of the majority language. A potential problem with including two or more languages on product labels is the amount of space available. Adding text of a second language could cause a reduction of text size of the primary language. Consequently, it may lower the likelihood of reading the material in part because legibility is

reduced because the amount of text appears more lengthy and seems to require greater effort to read than a monolingual label.

Potential solutions to this communicative problem can be derived from the last two decades of research in the Human Factors/Ergonomics (HF/E) literature on warnings. For example, the use of pictorial symbols [3], and label designs that expand the surface area could be used [4]. Another method is to better utilize the available space [5]. Different bilingual designs could be viewed more favorably than others and some might even be preferred over a monolingual label of their own language.

Those labels that users might prefer most are ones that place the user's own language in the primary position (on the top and left sides) and being larger in size [6]. One researcher [7] found that safety-related judgments were influenced by container shape. Because container shapes might influence how the labels are perceived on various shapes of containers, all the variation of label designs were placed on box and cylinder shaped containers and were compared.

Thus, this study investigated effects of different formats of bilingual labels and their shape of the containers. English and Spanish users rated the labels on (a) acceptability, (b) likelihood of purchasing product, and (c) the likelihood of reading to each of a set of systematically-manipulated bilingual label designs. The labels were affixed to actual box and cylinder shaped containers. Pesticide labels were used as they represented a product that would have hazards that would need to be warned about.

2. Method

2.1. Participants

A total of 64 individuals (32 males and 32 females) from Raleigh-Durham area of North Carolina participated. Ages of the participants ranged from 17 to 69 years ($M=36.09$, $SD=12.43$). All participants reported to have completed at least the 6th grade with the average educational level attained being the 12th grade of high school. One half of the participants reported being fluent in English but not in Spanish, and the other half reported being fluent in Spanish but not in English.

One half of the participants were recruited in front of a Spanish-theme grocery store. The other

half of the participants, English-language users, was recruited at a weekend flea (or swap) market.

2.2. Materials

Sixteen different label designs on semi-glossy, photo-quality paper were adhered onto two different container shapes. The label information of each stimulus was modeled after a pesticide product currently in use, a dry-powdered form that is marketed to home gardeners.

Consumer pesticide products come in either a box (square) or cylindrical (round) container. To have the label stimuli appear in a realistic context, actual box and cylinder containers were used.

For each condition, the stimuli were printed on one side of 8.5 inch (21.6 cm) x 11.0 inch (27.9 cm) white bond semi-gloss paper and were cut to fit onto the container. All formats were limited within the 2.75 inch (6.99 cm) X 8.5 inch (21.6 cm) surface area for the round container and 3 inch (7.62 cm) X 8.5 inch (21.6 cm) surface area for the square container. See Table 1 for label designs.

2.2.1. Vignette

Before examining the labels, participants were presented a short vignette.

Because of ongoing immigration, it is expected there will be a substantial increase in Spanish language users in the United States. As a consequence, manufacturers may begin to use bilingual labels to communicate warnings and direction in both English and Spanish. You will be asked to help choose specific label designs for use on consumer products, and in particular, a pesticide product.

2.3. Procedure

After the vignette, participants were asked to rate the level of acceptability of using the label in the U.S., likelihood of reading the label, and likelihood of purchasing a product having a label for each of the 16 bilingual label formats.

For the acceptability ratings, the 9-point rating scale ranged from 0 (not at all acceptable) to 8 (extremely acceptable). The other two ratings (likelihood of reading the label and purchasing a product with the label) used scales with anchors similar to those of the acceptability ratings.

Table 1
The 8 stimuli used for both the box and cylinder conditions.

<i>Format</i>	<i>English text</i>	<i>Spanish text</i>
English-only	ALL	NONE
Spanish-only	NONE	ALL
English-on-top-half	Top ½ portion	Bottom ½ portion
Spanish-on-top-half	Bottom ½ portion	Top ½ portion
English-on-top-two-thirds	Top 2/3 portion	Bottom 2/3 portion
Spanish-on-top-two-thirds	Bottom 2/3 portion	Top 2/3 portion
English-left-half	Left ½ portion	Right ½ portion
Spanish-left-half	Right ½ portion	Left ½ portion

The experimenters would refer to a sheet where the order of the labels was randomized. A participant was asked to read the vignette and use the rating scale of their response. Participants rated each of the 16 stimuli presented. Each participant was asked to rate the level of acceptability, the likelihood to read and the likelihood to purchase product given the label design before moving on to the next label.

3. Results

3.1. Initial analyses

Table 2 shows mean ratings (and standard deviations) of acceptability, likelihood of reading the label, and likelihood of purchasing product with the label for each of the 16 bilingual label designs (collapsed across user language). They are shown in order from highest to lowest on rated acceptability. One way repeated-measures analyses of variance (ANOVAs) for each of the three rating scales showed a significant effect of label designs for acceptability, $F(15, 945)=11.65, p <.0001$, likelihood of reading the label, $F(15, 945) = 12.61, p <.0001$, and likelihood to purchasing the product with the label, $F(15, 945) = 12.26, p <.0001$.

Tukey's Honestly Significant Difference (HSD) at $p = .05$ was 1.39 for the acceptability ratings, 1.39 for the likelihood to read ratings, and 1.31 for the likelihood to purchasing products. These criteria set at $p = .05$ allow easy determination of significant differences among the conditions in comparison to the difference between any two means in each set.

Additionally, intercorrelations among the 3 rating measures were very high, with all three ratings ranging from .95 to .98 ($p <.0001$)

Table 2 shows that all three rating measures yielded approximately the same pattern across conditions. Nearly the same conditions were rated highest and lowest for all three rating measures. Generally, participants rated the text designs with English text in the primary portions (top and left-half) of the bilingual label highest. The next highest rated designs were with each language displayed equally in halves. Participants' ratings indicated a preference for the box container over the cylinder container. The lowest ratings were for the Spanish only labels.

Because of indications of the similarity between the three rating measures, an "overall effectiveness" rating was formed by collapsing (means) across the three rating measures and this overall effectiveness measure was used as the dependent variable in the remaining analyses.

Analyses examined the relationship of demographic category (English-language users vs. Spanish-language users) using the overall effectiveness measure to determine if there were any differences. The first analysis used a mixed-model design using single demographic category as the between-subject factor and the 16 label designs (container type X 8 designs) as within-subjects (repeated-measures) factors.

3.2 Mixed Model ANOVAS

A 2 (Language users: English vs. Spanish) X 2 (Containers: Box vs. Cylinder) X 8 (bilingual label designs) mixed-model ANOVA showed that Spanish-language users ($M = 6.08, SD = 2.2$) gave significantly higher ratings than English-language users ($M = 4.79, SD = 2.6$), $F(1, 62) = 21.55, p <.001$. The means are shown in Table 3. A significant interaction of Language Users X Bilingual Label Designs was also shown, $F(7, 434) = 74.19, p <.01$. English-language users rated the English-only label ($M = 6.81$) higher than the Spanish-only label ($M = .47$), whereas, the Spanish-language users rated the Spanish-only label ($M = 6.49$) higher than the English-only label ($M = 3.05$). It is evident that English-language users rated the Spanish-only label far lower in acceptability than the Spanish-language users rated the English-only label.

Table 2

Mean and (standard deviation) ratings for acceptability, likely to read, and likely to purchase for the 16 bilingual label formats

Formats*	Acceptable <i>M (SD)</i>	Likely to Read <i>M (SD)</i>	Likely to Purchase <i>M (SD)</i>
1. BOX: English-Left-Half (English on left half and Spanish on right half)	6.85 (1.4)	6.96 (1.2)	6.82 (1.8)
2. CYLINDER: English-Left-Half (English on left half and Spanish on right half)	6.46 (1.7)	6.46 (1.8)	6.32 (2.1)
3. BOX: English-Top-Half (English on top half and Spanish on bottom half)	6.43 (1.9)	6.79 (1.8)	6.68 (1.9)
4. CYLINDER: English-Top-Half (English on top half and Spanish on bottom half)	6.14 (1.9)	6.06 (2.2)	6.04 (2.4)
5. BOX: Spanish-Left-Half (English on right half and Spanish on left half)	5.71 (2.3)	6.10 (2.2)	5.92 (2.4)
6. BOX: English-Top-Two-Thirds (English on top two-thirds and Spanish on bottom one-third)	5.84 (2.2)	6.25 (2.1)	5.93 (2.3)
7. CYLINDER: English-Top-Two-Thirds (English on top two-thirds and Spanish on bottom one-third)	5.68 (2.1)	6.01 (2.1)	5.92 (2.3)
8. BOX: Spanish-Top-Half (Spanish on top half and English on bottom half)	5.50 (2.4)	5.57 (2.5)	5.57 (2.5)
9. CYLINDER: Spanish-Left-Half (English on right half and Spanish on left half)	5.43 (2.5)	5.75 (2.4)	5.65 (2.4)
10. CYLINDER: Spanish-Top-Half (Spanish on top half and English on bottom half)	5.15 (2.6)	6.45 (1.4)	5.35 (2.6)
11. BOX: English Only (English text no Spanish text)	5.07 (2.7)	5.06 (3.1)	4.95 (3.1)
12. BOX: Spanish-Top-Two-Thirds (Spanish on top two-thirds and English on bottom one-third)	4.89 (2.9)	5.18 (2.8)	5.14 (2.8)
13. CYLINDER: Spanish-Top-Two-Thirds (Spanish on top two-thirds and English on bottom one-third)	4.65 (2.7)	5.00 (2.9)	5.04 (2.7)
14. CYLINDER: English Only (English text no Spanish text)	4.53 (2.9)	4.93 (3.1)	5.04 (3.1)
15. CYLINDER: Spanish Only (Spanish text no English text)	3.51 (3.5)	3.54 (3.6)	3.53 (3.5)
16. BOX: Spanish Only (Spanish text no English text)	3.43 (3.4)	3.37 (3.6)	3.50 (3.5)

* Shown in the order of highest overall agreement to disagreement on acceptability, likelihood to read, and likelihood to purchase products.

3.3. ANOVA—Language, Container, Primary & Secondary, and Location design.

In some of the remaining analyses only a subset of label designs conditions were included so as to form a full factorial. In the following analysis, only label designs were included except the bilingual labels divided into 2/3 and 1/3 split between English and Spanish, and the monolingual labels (English-only and Spanish-only).

A 2 (English vs. Spanish—language users) X 2 (secondary position vs. primary position) X 2 (left/right placement vs. top/bottom placement) X 2 (cylinder vs. box) mixed model ANOVA showed a significant main effect between user language $F(1, 62) = 22.67, p < .01$. Overall, English users ($M = 5.28$) gave significantly lower ratings to the label designs than Spanish users ($M = 6.82$).

The ANOVA also showed a significant main effect of secondary and primary positions on the label, $F(1, 62) = 19.99, p < .0001$. Users' prefer their

native language displayed in the primary ($M = 6.50$) placement (in the top or left portion than in the secondary ($M = 5.59$) placement (in the bottom or right portion) of the bilingual label.

The ANOVA also showed a main effect between left/right vs. top/bottom, $F(1, 62) = 13.28, p < .001$.

Generally, users' ratings were higher when the bilingual labels were in the left/right orientation ($M = 6.21$) than in the top/bottom orientation ($M = 5.89$).

The ANOVA revealed a main effect of container type, $F(1, 62) = 13.37, p < .001$. Generally, users rated the box-shaped container ($M = 6.24$) higher in perceived overall effectiveness than the cylinder-shaped container ($M = 5.85$).

There was also a significant interaction between secondary/primary and language users, $F(1,62) = 25.83, p < .0001$. Table 4 shows that both English-language users and Spanish-language users gave significantly higher ratings when their native language was located in the primary position. However, the English-language users showed a much

Table 3

Mean overall effectiveness ratings (collapsed across rating dimensions) of English-language users and Spanish-language user for the 16 Bilingual label formats

Formats	English Users	Spanish Users
1. BOX: English Only (English text no Spanish text)	6.98 *	3.37
2. BOX: Spanish Only (Spanish text no English text)	0.44	6.42 *
3. BOX: English-Top-Two-Thirds (English on top two-thirds and Spanish on bottom one-third)	6.85 *	5.16
4. BOX: Spanish-Top-Two-Thirds (Spanish on top two-thirds and English on bottom one-third)	3.35	6.79 *
5. BOX: English-Top-Half (English on top half and Spanish on bottom half)	6.44	6.83
6. BOX: Spanish-Top-Half (Spanish on top half and English on bottom half)	4.35	6.75 *
7. BOX: English-Left-Half (English on left half and Spanish on right half)	6.69	7.07
8. BOX: Spanish-Left-Half (English on right half and Spanish on left half)	4.78	7.05 *
9. CYLINDER: English Only (English text no Spanish text)	6.64 *	3.03
10. CYLINDER: Spanish Only (Spanish text no English text)	0.50	6.56 *
11. CYLINDER: English-Top-Two-Thirds (English on top two-thirds and Spanish on bottom one-third)	6.44 *	5.30
12. CYLINDER: Spanish-Top-Two-Thirds (Spanish on top two-thirds and English on bottom one-third)	3.29	6.51 *
13. CYLINDER: English-Top-Half (English on top half and Spanish on bottom half)	5.81	6.35
14. CYLINDER: Spanish-Top-Half (Spanish on top half and English on bottom half)	3.81	6.76 *
15. CYLINDER: English-Left-Half (English on left half and Spanish on right half)	6.07	6.77
16. CYLINDER: Spanish-Left-Half (English on right half and Spanish on left half)	4.26	6.96 *

* Indicates significant difference between English and Spanish users for the label design ($p < .05$).

more dramatic drop in their ratings when their native language was secondary. A much smaller drop in the ratings was given by Spanish-language users when their native language was in the secondary position. No other significant interactions were observed in the analysis.

4. Discussion

Users rated bilingual labels higher in perceived overall effectiveness when the text was displayed in left/right designs than a top/bottom designs. Users probably preferred a vertically oriented display because scanning for one's language may be easier from left to right than from top to bottom.

The results showed that English-language users had higher ratings of perceived overall effectiveness when their native language was located in the primary portion of the bilingual label than in the secondary portion of the bilingual label relative to Spanish-language users, who did not show such a large difference. Although both English and

Spanish-language users favored their native language highly in the primary portion of the bilingual label, Spanish-language users' ratings were not as negatively affected when their native language was in the secondary portion of the bilingual label. This result may indicate that Spanish-language users do not expect products sold in the U.S. to have the Spanish text in a primary position on bilingual labels.

The results showed that the box container design was rated highest on perceived overall effectiveness than the cylinder container design. This result may be due to the box's larger viewable surface area where the text is on a flat surface. The cylinder container shows only a portion of the text at any one time and because of its curvature, users require twirling the container back and forth when reading the label.

In the current research, designs where the Spanish text is in a less than favorable position, Spanish-language users still rated these designs higher than the English-language users. This pattern may indicate that the Spanish-language users in the

Table 4

Mean Perceived acceptability as a function of 2(English vs. Spanish) X 2 (secondary vs. primary) X 2 (left/right vs. top/bottom) X 2 (box vs. cylinder)

English–language users

		English in Primary Position							
		No				Yes			
Left/right vs. top/bottom		Right		Bottom		Left		Top	
Shape		Box	Cylinder	Box	Cylinder	Box	Cylinder	Box	Cylinder
Mean		4.78	4.26	4.35	3.81	6.69	6.07	6.44	5.81
Mean = 4.30					Mean = 6.25				

Spanish –language users

		Spanish in Primary Position							
		No				Yes			
Left/right vs. top/bottom		Right		Bottom		Left		Top	
Shape		Box	Cylinder	Box	Cylinder	Box	Cylinder	Box	Cylinder
Mean		7.07	6.77	6.83	6.35	7.05	6.96	6.75	6.76
Mean = 6.75					Mean 6.81				

U.S. are willing to compromise in having their language secondary to the English text.

Generally, participants were favorable of bilingual label designs with both languages (English and Spanish) equally displayed on the product (English text left and Spanish text right). This research could serve as some preliminary labeling guidance for manufacturers for hazardous products used by English language and Spanish language - users.

References

[1] U.S. Census Bureau. (2002). Projections of the resident population by race, Hispanic origin, and nativity: Middle Series. Washington, D.C.: US Census Bureau.
 [2] Lim, R.W. & Wogalter, M. S. (2003). Beliefs about Bilingual Labels on Consumer Products. Proceedings of the Human Factors Society 47th Annual Meeting, Human Factors Society, Santa Monica, CA 839-843.
 [3] Smith-Jackson, T.L., & Wogalter, M.S. (2000). User’s hazard perceptions of warnings components: An examination of colors and symbols. Proceedings of the 14th Triennial congress of the International

Ergonomics Association and 44th Annual Meeting of the Human Factors and Ergonomics Society, 5, 150-153.
 [4] Wogalter, M. S., Forbes, R. M. & Barlow, T. (1993). Alternative product label designs: Increasing the surface area and print size. Proceedings of Interface 93. Santa Monica, CA: Human Factors Society, 181-186.
 [5] Wogalter, M. S., Magurno, A. B., Dietrich, D., & Scott, K. (1999). Enhancing information acquisition for over-the-counter medications by making better use of container surface space. Experimental Aging Research, 25, 27-48.
 [6] Bzostek, J. A. & Wogalter, M.S. (1999). Measuring visual search time for a product warning label as a function of icon, color, column, and vertical placement. Proceedings of the Human Factors Society, Santa Monica, CA, 888-892.
 [7] Wogalter, M. S., Laughery, K. R. & Barfield, D. A. (1997). Effect of Container Shape on Hazard Perceptions. Proceedings of the Human Factors Society 41st Annual Meeting, Human Factors Society, 41st Annual Meeting, Human Factors Society, Santa Monica, CA 390-394.