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Connoted Hazard of Spanish and English Warning Signal Words, Colors, and Symbols by Native Spanish Language Users

M. S. Wogalter [A], L. J. Frederick [B], O. L. Herrera [A], A. B. Magurno [A]

[A] Department of Psychology, 640 Poe Hall, North Carolina State University, Raleigh, NC 27695-7801 USA

[B] Department of Safety and Environmental Management, College of Engineering and Mineral Resources, West Virginia University, Morgantown, WV 26506-6070 USA

1. Introduction

Signal words are used on signs, tags and labels for the purpose of quickly conveying the level of hazard to persons at risk. Several studies in recent years have investigated the connoted hazard of signal words such as DANGER and CAUTION (Bresnahan and Bryk, 1975; Chapanis, 1994; Dunlap *et al.* 1986; Leonard *et al.* 1986; Wogalter *et al.* 1994, 1995; Wogalter and Silver, 1990, 1995). All of these studies have used English language terms only. There has been increasing interest in the posting of multi-lingual warnings in locales where one would expect the population to benefit. The Spanish language has particular relevance in the U. S., where there is a growing population that uses Spanish exclusively. To develop such warnings for Spanish language users, warning designers must consider which signal words are appropriate. Wogalter and Silver (1995) showed that a certain subset of words was appropriate (based on hazard connotation and understandability measures) for young children, older adults, and native Spanish speakers. Some English signal words might communicate hazard information to non-English speakers, therefore the present study examines the connoted hazard of both English and Spanish signal words by native Spanish speakers.

Frequently, warnings also use non-text elements such as colors and symbols to call attention to the warning and to convey the level of hazard. Recent research using native English speakers (Wogalter et al., 1995; Kalsher et al., 1995) has evaluated some of the components recommended in the widely cited ANSI (1991) Z535 standard for warning design. Although these studies confirmed parts of the standard (e.g., red indicates greater hazard), other parts were not confirmed (e.g., people do not differentiate between orange and yellow in connoted hazard). The present study examines Spanish-language users' interpretations of colors and icons and whether their interpretations correspond with those of English users and the ANSI standards.

2. Method

Participants

Forty-eight Spanish speaking people living in or visiting the Raleigh, NC area were tested. Most knew little or no English. Eighty-five percent were from Mexico; 11% were born in the US but listed Spanish as their first language.

Materials and procedure

The Spanish terms (38) were selected from current Spanish warnings, dictionaries and a thesaurus. Additional terms were generated by three bilingual natives of Mexico, Colombia and Venezuela who suggested the equivalent words used in their countries for each of the English terms. If the Spanish word varied by country, all three words were included. The English terms (34) were chosen from earlier studies (e.g., Wogalter and Silver, 1990; 1995). Also included were 4 terms that were both Spanish and English words. Table 1 shows the 76 words tested.

The stimuli also included ten colors from the ANSI Z535.1 safety color standard. Six general warning symbols were evaluated. Table 2 lists the colors and symbols.

Table 1

Mean hazard ratings, standard deviations, and missing for Spanish and English signal words

L	Word	M	S	B	L	Word	M	S	B	L	Word	M	S	B
S	Explosivo	7.52	.90	0	S	Perjudicial	5.64	1.77	3	E	Crucial	4.44	2.09	14
E	Explosive	7.48	1.13	0	S	Se Prohibe	5.58	2.15	0	S	Atención	4.44	2.02	0
S	Peligroso	7.46	1.05	0	E	Caution	5.50	2.23	6	E	Attention	4.36	1.92	1
*	Mortal	7.38	1.33	0	E	Alert	5.48	1.54	2	E	Halt	4.36	2.10	34
S	Veneno	7.38	1.06	0	S	Corrosivo	5.41	2.44	7	E	Severe	4.34	2.16	16
*	Fatal	7.26	1.48	5	S	Alerta	5.40	1.74	1	S	Severo	4.31	2.29	6
E	Danger	7.16	1.40	11	S	Muy Importante	5.35	2.11	0	S	Inseguro	4.23	2.44	0
S	Peligro	7.15	1.07	0	S	Cuidado	5.30	1.91	1	E	Mandatory	4.23	2.12	17
E	Deadly	7.14	2.13	27	S	Importante	5.19	2.26	1	S	Fragil	4.22	2.36	2
E	Toxic	7.11	1.45	2	E	Forbidden	5.19	1.64	32	S	Prestar Atencion	4.21	1.88	0
E	Lethal	6.93	1.93	19	E	Careful	5.19	2.06	21	S	Serio	4.19	2.24	0
S	Toxico	6.89	1.70	1	E	Important	5.07	2.12	2	S	Aviso	4.10	2.06	0
S	Destructivo	6.73	1.68	4	S	Inpredecible	5.03	2.18	17	E	Critical	4.10	2.47	9
E	Disastrous	6.55	1.39	15	E	Beware	4.95	2.39	29	E	Necessary	4.09	2.45	4
E	Poison	6.37	2.53	18	E	Hazard	4.95	2.09	29	*	Observe!	4.04	2.17	0
S	Dañino	6.11	2.01	4	S	Obligatorio	4.93	2.43	3	S	Necesario	3.98	2.19	0
S	Prohibido	6.02	1.76	0	S	Detengase	4.92	1.93	0	E	Notice	3.86	2.47	5
E	Prohibited	5.95	1.83	4	S	Prevenga!	4.81	1.95	1	S	Nunca	3.84	2.70	3
E	Unsafe	5.95	1.99	27	E	Serious	4.78	2.26	12	S	Requisito	3.66	2.16	1
E	Harmful	5.95	2.12	29	E	Injurious	4.73	2.33	26	S	Información	3.57	2.17	1
S	Nocivo	5.89	2.20	10	E	Don't	4.71	2.37	17	E	Information	3.56	2.38	0
S	Riesgoso	5.89	1.78	1	S	Advertencia	4.67	2.21	0	E	Essential	3.55	2.20	19
E	Corrosive	5.88	2.24	14	*	No	4.62	2.49	3	S	Hazlo!	3.40	2.44	4
E	Warning	5.83	2.13	13	E	Never	4.62	2.64	9	S	Mandatorio	3.30	1.96	0
S	Precaución	5.75	1.70	4	E	Unpredictable	4.48	2.15	19	S	Anuncio	3.08	2.10	0
S	No se Exponga	5.73	1.94	0										

Note. L = Language: S = Spanish, E = English, * = Both; M = mean hazard rating; S = standard deviation; B = blank/missing value.

The order of stimulus types was randomized for each participant, and there were two random item orders within each stimulus type. The words, colors, and symbols were presented on separate sheets of paper. Participants rated each item on perceived hazard using a 9-point scale from "not at all hazardous" (0) to "extremely hazardous" (8). If they did not understand a word they were told to leave it blank.

3. Results

Table 1 shows the mean hazard ratings, standard deviations and missing values for Spanish and English terms. High standard deviations indicate inconsistent interpretations among participants. Greater missing values indicate lower levels of understandability. English terms with the fewest missing values often had similar spellings to Spanish words (e.g., EXPLOSIVE-EXPLOSIVO, PROHIBITED-PROHIBIDO). Overall, the ordering was generally consistent with English

Table 2

Mean hazard ratings, standard deviations, and missing for colors and symbols.

Color	Mean	SD	Missing	Symbol	Mean	SD	Missing
red	6.65	1.77	0	SKULL	7.33	1.46	0
orange	4.27	2.48	0	SHOCK	5.21	2.28	0
black	4.17	2.68	0	CIRCLE-SLASH	4.21	2.02	0
yellow	4.12	2.39	0	ASTERISK	3.67	2.49	0
green	3.17	2.50	0	ALERT SYMBOL	3.62	2.45	0
magenta	2.85	2.30	0	MR. YUK	3.17	2.72	0
blue	2.83	2.41	0				
brown	2.62	2.37	0				
gray	2.60	2.35	0				
white	2.35	2.22	0				

speakers in previous research, although the number of missing values in the present research is much higher. The Spanish terms produced very few missing values. The highest hazard connoting terms were: EXPLOSIVO, PELIGROSO, MORTAL, and VENENO. The Spanish term commonly used in U.S. warnings to denote the greatest hazard, PELIGRO, had lower ratings.

Table 2 shows the mean hazard ratings, standard deviations, and missing values for the colors and symbols. The color results were similar to previous studies with English users. Red connoted significantly greater hazard than all other colors, followed by orange, black and yellow which did not differ. The other colors had no hazard connotation.

Of the symbols, the skull was rated highest and had a hazard level equal to the highest level words. The electric shock symbol was next highest, followed by the prohibition symbol (a circle/diagonal slash). The other symbols had low hazard ratings.

4. Discussion

This study provides data on native Spanish speakers' perceptions of Spanish and English signal words. The results indicate that many commonly used English signal words were not well understood by the sample of Spanish speakers in this study. Thus, it suggests the importance of using Spanish terms in warnings intended for this population. The list of Spanish words shows a wide range of connoted hazard, which in application could be used in warnings for various levels of danger. Data such as these could be used to match Spanish and English words to their corresponding levels of hazard when producing bilingual warnings. Selection of words, however, should also consider understandability which was operationalized as low variability (standard deviations) and few missing values. Terms such as PELIGROSO, RIESGOSO, ALERTA, and AVISO might be appropriate substitutes or translations for the English signal words DANGER, WARNING, CAUTION, and NOTICE, respectively.

The color and symbol evaluations were similar to those of English-speakers (Wogalter et al., 1995). The red and skull might communicate hazard even if the associated words are not. Thus, this research provides data on potential components of warnings useful for the design of hazard communications to Spanish language users.

Most of the evaluations were performed using individuals from Mexico. The generality of the present results might be, to some degree, limited because certain Spanish words have different usage rates in different Spanish-speaking countries. Confirmation using individuals from other countries is necessary if the target audience has a broader range.

4. References

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