

WHAT DOES CODE RED MEAN?

BY CHRISTOPHER B. MAYHORN, MICHAEL S. WOGALTER, & ERIC F. SHAVER

The U.S. Department of Homeland Security developed the Homeland Security Advisory System (HSAS) as a means to disseminate information regarding the risk of terrorist acts. HSAS communicates a series of warnings in the form of five graduated threat conditions that utilize three distinct attributes: colors, words, and phrases. As the table below illustrates, each of these attributes is composed of five components that are ordered to communicate five distinct threat levels. The purpose of this additional study was to determine the effectiveness of HSAS as a means of public hazard communication by empirically assessing people's understanding of the system.

Our 57 participants (see page 7 in the accompanying article) were given a set of index card labels and asked to rank the colors, words, and phrases from most threatening to least threatening. During color label sorting, 57.9% of them erred by deviating from the correct order illustrated in the table below. When examining the specific errors made, we found that the most frequent errors occurred when participants thought the blue threat condition was less threatening than the green condition (78%). Another source of error resulted from participants confusing the orange with the yellow threat condition (12.1%). Together, these two categories of confusion account for more than 90% of the color-sorting errors.

The word-sorting task revealed somewhat better results: only 33.3% of the sample deviated from the correct order. Participants most frequently confused the guarded condition with the low condition (42.1%) and less frequently confused the elevated with the guarded condition (21.1%). Together, these two categories of confusion account for more than 63% of the errors during word sorting.

Participants were the most accurate when asked to order the descriptive phrases, compared with the other sorting tasks. In the phrase-sorting task, 26.3% deviated from the correct order. Participants most frequently confused "Significant risk of terrorist attacks" with "High risk of terrorist attacks" (26.7%) and less frequently confused "Severe risk of terrorist

attacks" with "High risk of terrorist attacks" (13.3%). Together, these categories of error accounted for 40% of the errors during phrase sorting.

The error-laden results of the three sorting tasks provide converging evidence that HSAS may not be an effective hazard communication tool. These results are not surprising when considered in the context of previous work within the human factors/ergonomics warnings literature (Laughery, Wogalter, & Young, 1994; Wogalter, Young, & Laughery, 2001). For instance, the results of the color-sorting task are consistent with previous research: Although the color red consistently connotes the presence of a hazard, orange and yellow are not readily differentiated on the hazard continuum (Chapanis, 1994). Colors such as red and yellow suggest greater levels of hazard than other common colors, such as green and blue, but research indicates that people do not perceive blue to be more hazardous than green (Braun & Silver, 1995; Rashid & Wogalter, 1997). Thus, participants' poor performance on the color-sorting task was predictable.

Had human factors/ergonomics professionals been consulted on the design of HSAS, the misunderstandings associated with color coding of threat levels might have been avoided, resulting in a more effective hazard communication tool. Similar confusions in the word- and phrase-sorting tasks might also have been avoided in light of extensive research demonstrating that people frequently have difficulty distinguishing one signal word from another, such as "danger," "warning," and "caution" (Braun, Kline, & Silver, 1995; Leonard, 1999). The designers of HSAS might have avoided the use of this attribute entirely.

At the very least, HSAS should have been tested prior to deployment to determine whether the public could distinguish among the five threat levels. Had this testing occurred and the findings reflected the confusion revealed in the present results, alternative attributes such as numbers (i.e., 1–5) or percentages (e.g., 80%) might have been explored as a means to disambiguate the threat levels.

*The
Homeland
Security
Advisory
System*



HSAS ATTRIBUTES AND ORGANIZATION OF COMPONENTS FROM MOST THREATENING (TOP) TO LEAST THREATENING (BOTTOM)

Colors	Words	Phrases
Red	Severe	Severe risk of terrorist attack
Orange	High	High risk of terrorist attack
Yellow	Elevated	Significant risk of terrorist attack
Blue	Guarded	General risk of terrorist attack
Green	Low	Low risk of terrorist attack