TECHNOLOGY-BASED WARNINGS: IMPROVING SAFETY THROUGH INCREASED COGNITIVE SUPPORT TO USERS

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New and emerging technologies promise to revolutionize risk communication. The benefits of technology are discussed with respect to the components of a recently described warning process model. Examples are provided to illustrate how technology can potentially improve information accessibility and cognitive support. Design principles such as warning interactivity, dynamic modification, and personalization are considered as potential applications of technology that should enhance warning effectiveness in future technology-based systems.

INTRODUCTION

The main purpose of warnings is to reduce the likelihood of injury to people and damage to property. Future warning systems will likely have properties that are different and better than traditional static warnings such as labels. Recent technological developments including new wireless handheld devices may provide dynamic warnings in applications heretofore not considered. This article describes how existing and future technology can be applied to warnings and risk communication to improve information accessibility and provide cognitive support. Here, cognitive support refers to the assistive aspects of technology which enhance the mental capabilities (and avoid the limitations) of users.

To demonstrate how technology-based warning systems might contribute to user safety, the benefits of technology adoption will be discussed in the context of a basic warning process model. The framework used in this article to organize our discussion of technologically-enhanced warning systems is described by Rogers, Lamson, and Rousseau (2000). In this model, a user's interaction with a warning involves four broad components: notice, encode, comprehend, and comply. Each component of the Rogers *et al.* (2000) framework is described in separate sections with examples provided to illustrate how technology might be implemented to benefit warning effectiveness.

NOTICE

The first stage in the Rogers *et al.* (2000) model is noticing the warning. The warning must first be noticed to be effective. In this stage, the warning ought to draw attention to itself to enable the processing of information to move to subsequent stages of the model.

According to Laughery and Young (1991), warning noticeability can be enhanced through the manipulation of physical design characteristics (e.g., adding a distinctive color, adding a pictorial symbol, or using larger font, etc). Yet color and most other physical design factors of traditional printed warning labels are static. They are passive in the sense that they do not change. A simple method used to improve noticeability is to have something that catches the eye such as a flashing light adjacent to a warning. This type of active or dynamic warning provides stimulus change that draws attention.

Why is stimulus change important for warnings? In some contexts, an unchanging stimulus can produce habituation which means that the stimulus is becoming less attractive of attention. Furthermore, when an individual is repeatedly exposed over time to the same stimulus, less attention tends to be given to that stimulus at subsequent exposures. Stimulus change may thus slow the habituation process.

Consider a road sign stating "Bridge freezes before the road." This sign is often permanently erected and visible during summer months when freezing is not relevant. As a result, it is appropriate to ignore the sign when the conditions are not relevant. This becomes a problem when people do not recognize the weather conditions make the sign relevant. A potential solution is to use temperature detectors so that presentation of the icy bridge sign is limited only to cold weather.

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