

Preface



As products, equipment, and environments become more technologically complex, many potential hazards associated with them have become less apparent. One of the ways to prevent accidents involving personal injury and property damage is to warn about them. The purposes of warnings are to inform persons at risk about hazards and to promote safe behavior.

Over the past 15 years or so there has been increasing interest in warnings and in research on the topic of risk communication. One probable reason for the earlier scarcity of warning studies is that research having applicability to real-world hazards is difficult to conduct. The foremost problem is that it is unethical to actually expose participants to hazards while manipulating different kinds of warning systems to see whether they comply. More recently, methodologies have been developed to measure compliance under realistic and safe conditions (without exposing participants to real hazards). Research has also examined aspects of the mental processes that precede compliance or, in other words, the intermediate stages of information processing between exposure to a warning and behavior.

Some of this research has been fueled by three other concurrent concerns. First there has been increasing interest in safety and health, in part because of rising health care costs and the pain and suffering that generally accompany injury and disease. The second interest in warnings derives from legal concerns. In the USA, the adequacy of warnings can play a large role in the initiation and outcome of a law suit. Third, governments and standards organizations around the world have mandated rules or issued guidelines on the design of warnings for a variety of situations.

As a consequence of the newly developed research methodologies, increased interest in safety and health, and the contemporary litigation milieu, there has been an upsurge in warning research. This book reviews, organizes and synthesizes theory of and research into warnings, including applications and applicable law. The broad coverage of warnings in a single volume should make this book of interest to a wide audience.

ORGANIZATION AND CONTENT

The book itself is a multi-authored edited volume with 15 chapters. The chapters are divided into five sections: Introduction, Methods/Techniques, Research on Warnings: Stages of the Model, Practical Issues of Warning Design, and Forensics. A short synopsis of each

section is given in the Contents section describing the general purpose of the subsequent chapters. In the following paragraphs, we offer a brief overview of these sections and chapters.

The first section, Introduction, contains two chapters. Chapter 1 by Laughery and Hammond introduces the area of warnings and risk communication, describing its importance and providing a short history of the field. The chapter also discusses the role of warnings in the hazard-control hierarchy. Chapter 2 by Wogalter, DeJoy and Laughery outlines the basic theoretical framework that the book adopts to organize the warnings research literature. The framework combines basic parts of both communication and human information processing models which we have labeled as the C-HIP model. The chapter describes how processing bottlenecks can prevent a warning from producing the desired safe behavior. Then the chapter discusses some of the limitations of a simple, linear model and extends this framework by suggesting that feedback from later stages influences earlier stages and that, under certain conditions, stages may be skipped entirely.

The second section, Methods/Techniques, introduces how research in this area is conducted. Chapter 3, by Young and Lovvoll, describes methods for investigating aspects of the intermediate stages of processing following exposure to a warning. Included are methods of measuring subjective impressions, memory, and eye movements. The limitations of these techniques are also discussed. Chapter 4, by Wogalter and Dingus, describes methods used for measuring behavioral compliance/adherence in a variety of situations including laboratory experiments and field evaluations.

The third section, Research on Warnings: Stages of the Model, comprises roughly half of the book. Each of the seven chapters in this section reviews research pertinent to a stage of the communication-information processing (C-HIP) framework. The first two chapters in this section are taken from the basic communication model, source and channel. The source concerns the originator/transmitter of risk information. There is limited research on this topic, which is rather surprising when one considers that warnings emanate from many sources, such as government, industry, trade associations and non-profit public service organizations. The perceived credibility (or lack thereof) of the source could add to (or detract from) the impact of the message. Because of the scarcity of research on this topic with respect to warnings, Cox, in Chapter 5, extracts theory and research from social-persuasion theory in discussing potentially relevant factors such as expertise, likeability, trustworthiness, and others.

The channel concerns the way the message is transmitted from a source to the receiver. Warnings can be transmitted through one of several sensory modalities, but usually vision and audition are the central focuses for warnings. Each of the senses has its own characteristic advantages and disadvantages. Consideration of the channel also concerns the kinds of media presentation that are used, delivering information through one or more sensory modalities. Different media can be more or less effective in different situations. Morris and Mazis, in Chapter 6, discuss these issues using research from both the warning and nonwarning domains.

The remaining group of chapters in the third section of the book concerns the processes that occur within the third part of the basic communication model, the receiver. Within the receiver, an effective warning undergoes a series of mental operations as described by a human information processing framework. At the receiver, processing starts with the information's arrival at the senses, and the processing may continue through intervening stages to produce changes in behavior.

Wogalter and Leonard, in Chapter 7, describe the factors important for capturing and maintaining attention. These factors include the characteristics of the message and

its surrounding environment. An effective warning will stand out (i.e., be salient) in cluttered and noisy environments. Once attention has been gained it must be maintained at least briefly so that information is transferred.

The next processing stage is comprehension and memory. In Chapter 8, Leonard, Otani and Wogalter describe the factors that facilitate understanding and retention of warning messages. Whether the text and symbols can be understood by the targeted groups are among the issues discussed. Additionally, strategies useful in developing prototype warnings are described. Emphasis is given to comprehension testing as a necessary step in the production of warnings. In addition, factors that influence the encoding, storage and retrieval of warnings in memory are presented.

In Chapters 9 and 10, DeJoy describes the next two stages of the model. The chapter on attitudes and beliefs reviews the literature on topics such as perceived hazard and familiarity. The chapter on motivation describes factors that energize users to comply with the warning-directed behavior, and these include costs of complying and anticipated severity of injury. In both chapters, various individual difference factors are described.

The last stage of the sequence of stages is behavior. Correct, safe behavior is the ultimate desired outcome of a warning. Silver and Braun, in Chapter 11, review the factors that have been shown to influence behavioral intentions and compliance, both positively and negatively.

The last two sections of the book address specific areas of application: one is the development of real-world warnings and the other is legal challenges. The two chapters in the section called Practical Issues of Warning Design give practical guidance on developing warnings. Collins, in Chapter 12, describes the content and process involved in forming standards and guidelines on warnings, and includes an extensive description of selected US government warning-related regulations. Guidelines, standards, and rules do not always provide adequate specification, but they can serve as a basis for initial design prototypes. Generally, testing is needed to verify the effectiveness of prototype warnings. Frantz, Rhoades, and Lehto, in Chapter 13, outline some of the practical methods of producing and evaluating warnings for use in real settings. This information should be particularly helpful to individuals who develop hazard communications for actual applications.

The last section of the book, on Forensics, describes the litigation aspects of warnings in the USA. Chapter 14 by Madden gives relevant US case law for warning design, including potential consequences of failure to warn. This chapter is also formatted in the style often used in legal writings. Laughery, in Chapter 15, describes the role and activities of the expert witness in warning-related litigation, and provides insight into how testimony is aided by a combination of research and analysis.

READERSHIP

We believe that this book will be of interest to several groups of people. One major group will be human factors professionals (ergonomists) who are involved in research, consulting, or expert witness work in legal cases concerned with warnings. Many of these individuals, both academics and practitioners, have been trained in psychology or in industrial engineering, and many of them hold memberships in the following professional organizations: Human Factors and Ergonomics Society, Division 21 of the American Psychological Association (Applied Experimental and Engineering Psychology), Ergonomics Society (UK), Canadian Human Factors Society, International Ergonomics Association, and other country-specific ergonomics organizations. Additionally, we expect the

book to be relevant and of interest to: (a) safety professionals, (b) technical communication professionals and documentation writers working with product manufacturers, (c) product designers, (d) persons involved in consumer marketing, and (d) attorneys involved in product liability and personal injury cases. Moreover, there are individuals in other specific areas (e.g., government agencies responsible for labeling and signage for specific products, equipment, and environments) that will find the information in the book useful. We believe the book could be a text in college seminar-type classes (special or advanced topics courses) for graduate students and advanced undergraduates in human factors and ergonomics and in other allied fields.

Readers will achieve maximum benefit if they have had some exposure to basic behavioral science research and associated methodology. However, we have tried to ensure that readers without this background will understand most of the conceptual content. Because some of our target audience will not have knowledge of some technical jargon, we have tried to limit its use and where it inevitably occurs, we have tried to include additional explanation and examples.

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Finally, we hope this book will stimulate critical discussion on the current state-of-the-art of warnings, and that it will help generate new and better ideas concerning warning design and effectiveness as well as the methods used for research and application. Most importantly, such progress should produce better methods of communicating risk information that ultimately will reduce the likelihood and extent of personal injury and property damage.