

# HUMAN FACTORS PERSPECTIVES ON WARNINGS, VOLUME 2

*Selections from Human Factors*

*and Ergonomics Society*

*Annual Meetings, 1994–2000*



Edited by

Michael S. Wogalter

Stephen L. Young

Kenneth R. Laughery, Sr.



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### From the Introduction...

"The ultimate goal of any safety system is the prevention of accidents and injury. The often-cited safety hierarchy suggests that the first line of defense in such a system is safe design – where possible, products should be designed to reduce the risk of injury to the user... When hazards are not or cannot be addressed through [guarding against hazards, training users, or providing protective equipment] (and even in certain instances in which they are), warnings can be employed to inform users of potential hazards. Because warnings are considered the last line of defense against potential injury, they can often play a significant role in the safety of a product or environment... Researchers from many disciplines have contributed to the growing body of scientific literature on warnings – a substantial portion of it from human factors/ergonomics (HF/E) researchers who have presented their work at Human Factors and Ergonomics Society annual meetings. Groups outside the HF/E field have become increasingly interested, such as professionals in law, manufacturing, and government, and practitioners and researchers in safety-related areas like communications, engineering, health care, marketing, and industrial hygiene."

Following on the success of its predecessor, this second volume contains 59 top-rated full papers and 52 abstracts from the years 1994–2000 of HFES Annual Meeting proceedings, plus a complete bibliography of meeting presentations on warnings and hazard communication since 1973. These papers can help professionals in all areas related to warnings and safety understand the factors that are influential in the design of effective warnings.

### ABOUT THE EDITORS

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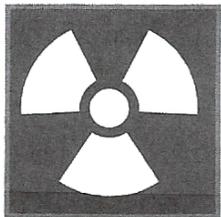
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# Introduction

The ultimate goal of any safety system is the prevention of accidents and injury. The often-cited safety hierarchy suggests that the first line of defense in such a system is safe design—where possible, products should be designed to reduce the risk of injury to the user.

In many situations, potential hazards may be an inherent part of the utility of a product (e.g., a chainsaw's ability to cut), making it difficult or impossible to eliminate hazards entirely through design. The next line of defense is to guard against potential hazards by preventing the user from encountering the threat. However, it may not be possible to guard against some hazards, or it may not be possible to guard against particular hazards completely. The next line of defense, in certain situations, could include things like training and personal protective equipment. These methods are generally more applicable in industrial settings but can be a viable solution in some cases for consumer products.

When hazards are not or cannot be addressed through any of the aforementioned methods (and even in certain instances in which they are), warnings can be employed to inform users of potential hazards.

Because warnings are considered the last line of defense against potential injury, they can often play a significant role in the safety of a product or environment. Thus, it is not surprising that warnings have received a great deal of attention in the research literature. Researchers from many disciplines have contributed to the growing body of scientific literature on warnings—a substantial portion of it from human factors/ergonomics (HF/E) researchers who have presented their work at Human Factors and Ergonomics Society annual meetings. As the warnings literature has grown, groups outside the HF/E field have become increasingly interested in the topic, such as professionals in law, manufacturing, and government, and practitioners and researchers in safety-related areas like communications, safety engineering, health care, marketing, and industrial hygiene.

Because the HFES annual meeting proceedings have a limited reach into these areas, we collected some of the most-sought papers from past proceedings. The resulting publication, *Human Factors Perspectives on Warnings: Selections from Human Factors and Ergonomics Society Annual Meetings 1980–1993*, broadened access to this valuable segment of the warnings literature and continues to be in demand. This second volume supplements the first book, covering the years 1994 to 2000. It contains 59 full articles, 52 abstracts, and a comprehensive bibliography of almost three decades of warning research. Although Volume 2 covers only seven years, it contains more papers than the first book, testifying to the growth in research in this domain. Our aim in producing these books is to enable professionals in all areas related to warnings and safety to learn about the factors that are influential in the design of effective warnings.

The papers in this second volume are drawn mainly from presentations sponsored by the HFES Safety Technical Group, Consumer Products Technical Group, and Forensics Professional Group.

## Content of the Book

Although this book focuses on the warnings literature, the area is broad and is represented by a variety of stimuli, methods, tasks, users, and environments. The stimuli include auditory verbal warnings, signs, product labels, owner's manuals, instruction sheets, and pictorial symbols. The methods and tasks include ratings of subjective perceptions, beliefs, and motivations. The research includes techniques involving response time, comprehension and memory assessment, and various behavioral compliance measures concerning an assortment of scenarios and situations. Users include participants from such groups as university students, industrial workers, experts and novices, disabled individuals, young children and their parents, older adults, and non-English speakers.

The data in this work have been collected in controlled laboratory environments and in field settings in such places as industrial complexes, automobile repair facilities, university and office buildings, and flea markets. Some papers deal with warning-related topics such as perceptions of risk and judgments about the allocation of responsibility in injury scenarios. Most of the material in the book is empirical research with some data collection and analysis. A much smaller proportion of the contents encompasses literature reviews or models and theory. Despite the wide variety of content, the common thread in all the papers is that they relate to the factors influencing hazard communications.

## Evaluation Process

In the first volume, papers were selected based partly on records of the most-requested warning articles. For the second book, we asked reviewers to assist us in determining which articles should be reprinted and used a

multistage method followed by editors of HFES annual meeting proceedings collections on other topics. Initially, 171 papers were compiled from the 1994-1999 proceedings. From those papers, the three editors selected a more focused list of 88 items, which were reviewed by judges knowledgeable about warnings research.

At about the same time that the judges were completing their ratings on the 1994-1999 papers, HFES held its 44th Annual Meeting, cohosted with the International Ergonomics Association (IEA) 14th Triennial Congress in August 2000. The proceedings from this meeting included many high-quality papers on warnings. As a consequence of having a rich new source of papers, we had another set of judges review 48 papers from this group. All of the reviewers have conducted, directed, and/or authored research-related projects on warnings in the last 10 years.

The judges gave an overall rating for each paper based on how well it met the following criteria:

- focus on warnings;
- inform about important principles and theory;
- include empirical measurement of behavioral effectiveness or precursor processes such as attention and comprehension;
- remain current in the near future;
- benefit purchasers and readers;
- be helpful to persons producing guidelines, standards, and regulations;
- be useful to attorneys and expert witnesses involved in litigation;
- be of high quality;
- represent HFES well.

The full articles in this book are those that the reviewers and editors believed most strongly should be included. The abstracts section, which is derived from both full papers and abstracts of poster presentations, contains only abstracts that substantively describe research. Note that some abstracts and bibliographic entries are included in these sections because of length constraints or because they were less central to the main focus, not because they represent "second-class" work. Examples of topics that received somewhat lower priority concerned nonverbal auditory sounds, simple labels on machine controls and displays, and highway signage.

To make this volume an even more useful reference source, we have expanded the bibliography to include all full articles and abstracts related to warnings that were published in the HFES annual meeting proceedings since 1973.

## **How to Use This Book**

There are three ways to locate information in this collection. Full papers appear first, in alphabetical order by primary author. Abstracts follow this section and are also presented in alphabetical order by first author. The author and subject indexes identify all authors and the major concepts addressed in the full papers and abstracts. The bibliographic entries are listed alphabetically by primary author and are not indexed.

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We hope that this collection, along with the first volume (Laughery, Wogalter, & Young, 1994), will occupy an important place in your safety library for many years to come.

Mike Wogalter  
Steve Young  
Ken Laughery  
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