

Handbook of Warnings

Human Factors
and Ergonomics

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Edited by
Michael S. Wogalter

Handbook of Warnings



"*Handbook of Warnings* has been edited by the most prolific writer and the leading international authority on warning design and use. The Handbook provides the theory design, usage, litigations, and case studies relating to warning. The design of effective human-centered warnings which comply with standards will tend to reduce error rates, mishaps, and accidents."

—Gavriel Salvendy, *Purdue University, Series Editor, Human Factors and Ergonomics*

Warnings are some of our most important communications. They are commonly used to prevent personal injury and property damage. In some circumstances, a failure in the warning process can lead to death or devastating injury. Therefore, warnings are being asked to perform a substantial role in the welfare and safety of people, and effective warnings are an important, serious concern.

Handbook of Warnings presents a technical discussion of warning including theory, research, and application. It describes warning design standards and guidelines; aspects of law relevant to warnings such as government regulations, case/trial litigation, and the role of expert testimony in these cases; and international, health/medical, and marketing issues. Broken into thirteen major sections, the chapters in this text cover theory, research, applications, and law, and many different perspectives on topics associated with warnings. No other book gives a more comprehensive treatment of warnings.

This handbook will appeal to those whose study, work, or research concerns the design of hazard communications by linguistic, symbolic, and auditory means. This book should be of special interest to human factors and ergonomics professionals, safety engineers, product and process design engineers, and trial lawyers.

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HANDBOOK OF WARNINGS

EDITED BY

MICHAEL S. WOGALTER
North Carolina State University



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To my parents, Laura and Ralph
and
to my sister and brother, Rosanne and Kevin
and
to all of my family, friends, colleagues, and students.

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SERIES FOREWORD

With the rapid introduction of highly sophisticated computer, (tele)communication, service, and manufacturing systems, a major shift has occurred in the way people use technology and work with it. The objective of this book series on Human Factors and Ergonomics is to provide researchers and practitioners a platform where important issues related to these changes can be discussed, and methods and recommendations can be presented for ensuring that emerging technologies provide increased productivity, quality, satisfaction, safety, and health in the new workplace and the Information Society.

The present volume, *Handbook of Warnings*, has been edited by the most prolific writer and the leading international authority on warning design and use. The Handbook provides the theory, design, usage, litigations, and case studies relating to warning. The 63 chapters of the Handbook provide the complete breadth and depth of the discipline of warnings,

which is illustrated in over 220 figures and more than 65 tables. Over 3,800 references are provided for further in-depth study on warning design, use, and litigations.

Design and use of warnings are a supplement to, and not a substitute for, safe products and process design, effective selection of personnel, and the implementation of sound education and training methods. However, the design of effective human-centered warnings that comply with standards will tend to reduce error rates, mishaps, and accidents. Thus, the effective use of this Handbook will contribute to the reduction of errors, mishaps, accidents and effective use of this will increase the ease of interaction of people with the surrounding environment. The Handbook should be of special use to human factors and ergonomics professionals, safety engineers, product and process design engineers, and trial lawyers.

—Gavriel Salvendy
Series Editor

FOREWORD

The past few decades have witnessed a substantial increase in research on warning design and effectiveness. Theoretical perspectives have been proposed, methodological issues have been explored, and a considerable body of research findings have been reported. This volume represents a landmark event in this important and growing field of work.

Warnings have an important role in safety. Their purpose can be viewed from a few different perspectives. At a general level, warnings are intended to reduce or prevent accidents, injuries, health problems, and property damage. At a different level, warnings can be regarded as a method for communicating safety-related information to a target audience who can then make better informed decisions regarding safety issues. This second goal is related to people's right to know, that is, to be informed about safety problems confronting them. A third perspective is that warnings are intended to influence or control people's behavior in ways that will result in improved safety. A final purpose, applicable in some situations, is that warnings are intended to remind people, that is, to call into awareness important and timely safety information or knowledge that may otherwise be latent in long-term memory.

In dealing with hazards associated with environments, products, or tasks, warnings are generally considered a third line of defense, behind design and guarding. This classic hazard-control hierarchy defines a sequence of preferred safety strategies. If one is unable to eliminate hazards through alternative designs, and if it is not possible to effectively separate people from the hazards through guarding, then warnings offer a strategy for achieving safety by providing important information to the human(s) involved.

The effective communication of warnings, however, is not a simple matter. What needs to be warned, when to warn, and how to warn are only a few of the relevant questions important to the warning designer. The information processing abilities and limitations of people represents a substantial domain of knowledge that is relevant to the designer. There are also numerous issues associated with the target audience, that is, those who are being warned. People are not always reliable; we are seldom the same today as we were yesterday, and we will very likely again be different tomorrow. Further, no two people are ever exactly alike. We vary on virtually every dimension including experience, language, competency, and so on. These factors also represent challenges to the design of warnings.

Warnings research in recent years has made good progress on virtually all of these fronts. We know a great deal more than we did 30 years ago about how to design warnings so that they are more likely to be effective. We have learned about some of the factors that may "get in the way" of a warning being effective, such as familiarity and cost of compliance. We also better understand that warnings are no safety panacea. There are often limitations on what can be accomplished with warnings. Indeed, these limitations are the reason warnings are the third line of defense in dealing with hazards.

In this volume, the perspectives, issues, challenges, and factors previously mentioned as well as numerous other considerations associated with the design and effectiveness of warnings are addressed by leading researchers and scholars in the field. The chapters on theory and models and those on research methodology provide the reader with a broad perspective within which to view and evaluate the status of warnings research. The substantial coverage of effective warning design issues represents the most complete presentation of this subject matter to date.

One sign of a maturing field of warnings research has been the emergence of various standards and regulations regarding warnings. Several chapters provide the reader with examples of regulations that cover a broad spectrum of warnings applications.

The volume also contains a section with several chapters on the role of warnings in civil litigation. Warnings have come to play a significant role in product liability and personal injury litigation. The reader should find this group of chapters most interesting.

The final section in the book contains some specific applications of warnings along with selected case studies. Here the reader can find important examples of the role of warnings.

In summary, this Handbook represents a major contribution to the field of warnings. The editor, Michael Wogalter, is to be congratulated for his selection of topics, the manner in which they are organized, and the exceptional array of authors he has recruited. This volume should occupy an important place on the shelf of all who share an interest in the role of warnings in making our world a safer place.

—Kenneth R. Laughery, Sr.