Warnings are much more than most people think they are. Arguably 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. Thus, warnings are being asked to perform a substantial role in the welfare and safety of people. Clearly, then, effective warnings are an important, serious concern.

Advancements in technology have enhanced our lives. However, technology has brought new hazards. Consider some common household products such as cleaning solutions and medications. Without some form of labeling and warnings, we would not know about these products’ hazardous potential. In other words, the hazards are not apparent, and in many cases, it is nearly impossible to tell just by looking at a product what the hazards are. In these cases, warnings are needed to enable safe use. Unfortunately, many warnings are being used in a broad array of actual applications that are poorly designed, reducing their effectiveness to perform their role of hazard control.

Over the last 2 to 3 decades, numerous warning design standards and guidelines have been developed and promulgated. During the same time period, there has been tremendous growth in the research literature on the factors that increase and reduce warning effectiveness. As a consequence of these developments, plus the growth of product liability and personal injury cases in the United States, there has been substantial interest in warnings in recent years.

Most warnings research has been conducted and published in the human factors and ergonomics (HF/E) area. HF/E is the study of the interface between people and technology, or more specifically, how people cognitively and physically interact with products, equipment, environments, and tasks. Most HF/E researchers have background and interest in psychology, engineering, and/or design. Just in the psychology arena alone, warnings' effects can be traced across the domains of perception, cognition, attitudes and beliefs, motivation, and behavior. Indeed, warning effects cut across the breadth of human abilities and limitations and can be manifested in a wide variety of ways.

Besides HF/E, many other disciplines including communications, safety engineering, health/medical, marketing, and law have contributed to the growing body of technical literature on warnings. This multidisciplinary interest and relevance of warnings has resulted in several separate bodies of literature related to the topic. This major compendium reviews and organizes this varied literature. The Handbook’s immense size reflects the broad scope and wealth of information on the topic.

Primarily, the book presents a technical discussion on warnings, including theory, research, and application. Much of the research and theory can be organized using the communication-human information processing (C-HIP) model. An overview can be found in chapter 5 (Wogalter, this volume). Although this book has a considerable academic inclination, there are numerous chapters addressing various application areas. This “applied” material concerns warning design and use and the challenges in real-world and legal settings. Combining both research and application not only promises the obvious benefit of better prevention but also helps direct future research in the area.

Included are chapters that describe warning design standards and guidelines, including the American National Standards Institute’s Z535 standard. Other chapters describe aspects of law relevant to warnings, such as government regulations, case/trial litigation, and the role of expert testimony in these cases. Still other chapters concern international, health/medical, and marketing issues. These perspectives are very different and have important implications for each other.

The book is a multiauthored edited handbook. It contains 63 chapters and an appendix of standards referenced in the chapters. All of the chapters are peer reviewed by the Editorial Advisory Board (see page xxiii) and the ad hoc reviewers (listed later in the Preface). The book has more than 200 figures and 60 tables. Although most of the figures are black and white, selected color examples are provided across 8 plates. The chapters are grouped under 13 major sections: Introduction, Research Methodology, Modeling the Process, Source and Extensive Factors, Guidelines From Research, Development Methods, Regulations, Civil Litigation, and Selected Applications and Case Studies. These sections and chapters cover theory, research, applications, law, and many different perspectives on topics associated with warnings. No other book gives a more comprehensive treatment of warnings.

The warnings literature has moved forward at a fairly rapid clip in the last few decades, but it now appears to have reached a maturing point. Unquestionably, there will still be many new innovations in the warnings area in future years. The last chapter...
AUDIENCE

The main target audience of this Handbook is persons whose study, work, or research concerns the design of hazard communications by linguistic, symbolic, and auditory means. Much of this group is comprised of HF/E professionals (employees, consultants) working with industry and government, as well as faculty and students working in education and research in areas related to psychology, industrial engineering, and technical communications. In addition, the blending of research, theory, and application sections should also be informative to a much wider array of target audiences. These groups include professional safety engineers, health and medical professionals, occupational safety specialists, consumer product and industrial equipment designers, government regulators of consumer products and industrial safety, documentation writers, and plaintiffs and defense attorneys involved in product and premises liability claims. In particular, individuals in the safety and legal professions should find this Handbook valuable in aiding judgments as to whether a warning is needed or whether the one being considered is adequate. The book should also be useful to individuals who need to develop hazard communications in actual applications. Because of the wide range of areas having interest in warnings, this reference source is likely to be found in university libraries, government agencies, corporate libraries, consulting services, law offices, and of course, the offices of researchers interested in warnings.

Readers with some basic behavioral science background will find the chapters most accessible. Readers without this background should greatly benefit from the content, too. This Handbook could be appropriately used in a special topics course in a graduate curriculum, such as in HF/E, applied cognitive/experimental psychology, and engineering psychology programs. In addition, the book could be used in communication, industrial engineering, and design programs.

CHAPTER AUTHORS

The chapter authors are highly respected individuals from academic, industry, consulting, government, and law. They contributed to this volume at the invitation of the editor. Every chapter was reviewed by one or more individuals from the Editorial Advisory Board and/or one or more from a knowledgeable group of ad hoc reviewers. Not only were excellent chapters produced, but contributors allowed the editor to put them through one or more review and resubmission cycles. More than one cycle was the norm. This high quality collection is a result of their hard work and productive efforts.

EDITORIAL ADVISORY BOARD

The Editorial Advisory Board (see list on pp. xxi) is a special group of individuals. Many of them helped in developing the initial structure of the book and as a group helped to guide the Handbook’s formation and development. Almost all of them served as a reviewer for one or two chapters. Some did more than one review. They helped make this Handbook a credible and valuable resource.

AD HOC REVIEWERS

An appreciative thank you is given to the reviewers who gave their expertise and time in providing comments to chapter authors. Their excellent comments and criticisms helped to guide chapter authors in producing higher quality manuscripts.

List of Reviewers

Austin Adams
University of New South Wales

L. Dale Baker

Heather Jane Barnes
HumanCentric Technologies, Inc.

Ann Bramer
U.S. Food and Drug Administration

David Burns
3M Company

James R. Cahan
Pacific Science & Engineering Group

Deneida L. Collins
National Institute of Standards and Technologies

Richard D. Gilson
University of Central Florida

William E. Gale, Jr.
Bundy, Gale, & Shields, LLC

Sam Glucksberg
Princeton University

Thomas K. Greenfield
National Alcohol Research Center

Ralph Norman Haber
Human Factors Consultants

Steven M. Haiz
Applied Safety and Ergonomics, Inc.

James Hartley
University of Keele

Richard D. Gilson
University of Central Florida

William E. Gale, Jr.
Bundy, Gale, & Shields, LLC

Sam Glucksberg
Princeton University

Thomas K. Greenfield
National Alcohol Research Center

Ralph Norman Haber
Human Factors Consultants

Steven M. Haiz
Applied Safety and Ergonomics, Inc.

James Hartley
University of Keele

Haj Hendrick
Hendrick & Associates

Richard Hornick
Hornick & Associates

James A. Kleiss
Ergolabs, Inc.

Dean M. Krugman
University of Georgia

Kaeen Lechel
U.S. Food and Drug Administration

Michael K. Lindell
Texas A&M University

Kevan Malkowitz
North Carolina State University
Michael Mazis
American University
James F. McElwee
Square D Company
Christina C. Mendat
North Carolina State University
Kathleen Middendorf
Consultant, St Clair Shores, MI
Roger W. Morell
GiroTech Corporation
Daniel G. Morrow
University of Illinois, Urbana-Champaign

Rudolf G. Mortimer
University of Illinois, Urbana-Champaign
Kenneth E. Neuliep
HFE Consulting, Inc.
Stuart W. Parsons
Barrows & Associates
George Peters
Law Offices of Peters & Peters
Charles E. (Dick) Sawyer
U.S. Food and Drug Administration

Jennifer Silk
U.S. Occupational Safety and Health Administration
Robert Sorkin
University of Florida
Bruce N. Walker
Georgia Institute of Technology
Sharon White
U.S. Consumer Product Safety Commission

ACKNOWLEDGMENTS

A very warm thank you goes to Ken Laughery of Rice University. Not only did he contribute several chapters and the Foreword, but he was also my final graduate advisor. He has been a mentor, collaborator, and friend. He has been a great model to follow. I can't thank him enough.

I also would like to thank some of my closest colleagues. They more than enhanced my scholarly activities and academic life: Mike Kalsher, John Brelsford, Tonya Smith-Jackson, Bernie Racicot, Ted Silver, Scot Allman, Dave Leonard, and more recently, Chris Mayhorn. Also, I thank some other very influential individuals: Jamie Pennebaker, Arthur Shulman, Jim Best, Pam Neill, David M. Lance, Craig Anderson, Sarah Burnett, Mike Warnkin, Bill Howell, Ken Blick, Blair Sternecker, David Martin, Mark Wilson, Denis Goy, Don Mesch, and Shari Converse-Lane.

Warmest gratitude to my former graduate students, for whom I chaired their thesis and dissertation committee: Bill Vigilante, Brad Marwitz, Ellen Martin, John Cayard, Todd Bartow, Eric Shaver, Russell Sojourner, Vince Corrada, Ray Lin, Steve Jarred, Rhonda Forbes, Diane Luytjssen, Kurt Goetjen, Amy Magnano, Rana Barregar, Laura Yurko, Kevin Hicks, and Kimberly Bransley. Every one of them has published research out of my lab. Also many thanks to Steve Young who started with me as an undergraduate student at the University of Richmond and went on to make scholarly contributions to warnings. Many other students, graduate and undergraduate, also contributed to research in my lab. I cannot list them all here, but a few special ones include Rahel Rashid, Kelly Drake, Christina Mendat, Jennifer Cowley, Grace Yen, and Jennifer Snow-Wolff.

The editor would also like to thank Gavriel Salvendy of Purdue University for his encouragement from the start of this project to the end, as the Human Factors/Ergonomics series editor at Lawrence Erlbaum and Associates (LEA), he had the foresight to investigate this book. His support also helped get it completed. As an eminent statesman of the Human Factors/Ergonomics field, he is a good person to emulate. Few people could have gotten me to do so much work.

Finally, my sincerest thanks goes to the individuals associated with LEA. Bill Webster helped sign me on to the project. His interest and encouragement pointed me in the direction of building the book I could. Later, Anne Duffy took over Bill's position on the project. I am indebted to Anne for making arrangements and advancing the raw manuscripts to become this exceptionally good-looking book. I know that she handled many obstacles during production behind the scenes that I did not see, for which I am most appreciative. I would also like to thank Kristin Duoh, an editorial assistant at LEA, who was consistently prompt and helpful throughout the process. I look forward to continued cooperation and collaboration with the copyediting and production staff at LEA.

Copyediting and production of the book was performed by Techbooks as contracted with LEA. Matt Byrd, the production manager of Techbooks, was always helpful and positive throughout the process. I am so grateful to him and his staff of compositers for their help in moving this large book with multiple authors through to completion on schedule. Not a small feat with such a large book.

The editor also wishes to thank Theresa Costello who helped me finalize the manuscripts and Leonard Rosenbaum for his highly competent work on the indexes.

Last, a general thank you to the attorneys with whom I have interacted, on both sides of cases, as an expert. The different cases over the years have revealed many of the complexities of warnings. The cases document, sometimes in vivid detail, people's behavior in real-world situations. As a psychologist, this information has been great fodder.

I hope this book helps to advance knowledge that leads to better warnings.

—Mike Wagalter
Raleigh, NC