TRAFFIC SAFETY AND HUMAN BEHAVIOR

SECOND EDITION

TRAFFIC SAFETY AND HUMAN BEHAVIOR

Second Edition

BY

David Shinar
Ben Gurion University of the Negev,
Beersheba, Israel

United Kingdom – North America – Japan
India – Malaysia – China

Emerald Publishing Limited
Howard House, Wagon Lane, Bingley BD16 1WA, UK

First edition 2007

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN: 978-1-78635-222-4 (Print)
ISBN: 978-1-78635-221-7 (Online)
ISBN: 978-1-78714-633-4 (Epub)

ISOQAR certified Management System, awarded to Emerald for adherence to Environmental standard ISO 14001:2004.

Certificate Number 1985
ISO 14001

INVESTOR IN PEOPLE

To

Naomi and Yuval, who contributed by just being and by giving me a new perspective on life. May all the safety issues raised here be resolved by the time they can read this.

Preface to the Second Edition

> "Understanding the human side of driving is critical for making large-scale improvements in traffic safety." (Njord and Steudle, 2015, p. 3).

This second edition came into being as a result of a confluence of three factors: the publisher's suggestion that it is time for an update, my entry into a new phase of my professional life (emeritus), and my realization that in the past 10 years there has been a most significant expansion in our knowledge about driving and safety. Much of the new research was spurred by changing cultural norms that emphasize sustainability (including sustainable safety), and from gradually evolving perceptions concerning the critical issues of safety and mobility. Let me elaborate here about the last – more substantive – factors: added knowledge, cultural change in our norms, and change in the critical issues of road users' behavior in the context of traffic safety.

In terms of cumulative knowledge, we have experienced (and are still experiencing) an explosion of interest and empirical research related to the safety of mobility: driving, riding, and walking. Prior to the first edition of this book, I was able to find only 17 books that were directly related to road safety. But in the 10 years since the publication of the first edition in 2007, 28 more book have been added to the list. The books, of course, only reflect the tip of the publications iceberg. There is a much greater increase in dedicated scientific conferences and refereed articles of original research. For example, Google Scholar lists approximately 62,000 articles containing all the words "road," "safety," "behavior," and "driving or riding" published prior to 2007, and over 70,000 in the 9 years since then. Narrowing the search scope to the combination of "traffic safety" and "human behavior" yields approximately 2,300 articles published prior to 2007, and over 3,000 since then. As cynical as one might be about the plethora of new and not-so-significant articles, with such a wealth of information there are bound to be some novel and unexpected findings. And there are. Consequently, each of the book chapters has been supplemented with new findings that either confirm previously drawn conclusions or refute them and merit new thinking.

The cultural shift was a gradual one that started in the last century and gained normative acceptance in this last decade. In the past, traffic crashes – invariably labeled as accidents – and injuries were accepted as part of the cost of mobility. But Sweden's 1997 policy shift to "Vision Zero" meaning striving toward zero traffic fatalities, was the harbinger of the new norm of zero tolerance for road fatalities. This has been translated to a practical yet aggressive goal for continued reduction traffic fatalities. This goal, common to both national and international institutions is to cut fatalities by 50 percent every 10 years. Commitment to such a demanding goal requires close cooperation among different agencies and careful considerations of the impact of changes in

the traffic system on the behavior of its road users. These implications are discussed in nearly every chapter.

Finally, within the realm of traffic safety and human behavior the specific "hot" issues of concern, and approaches to crash prevention and injury reductions have also changed over the past decade. For example, interest and research in aggressive driving and its contribution to crashes peaked around 2004-2005 while I was writing the first edition of this book. But the interest in distracted driving was nearly nil before 2009 and has been rising fast since then with no signs of abatement as of this writing (based on Google Trends). Distracted driving research – or at least the focus on it – is fueled by the constantly expanding technological communications and advanced driver assistance systems. These are brought into the cars by their manufacturers or by their drivers, and can both aid and impede safety.

Instead of the behavioral crash countermeasures – such as education, public information, and enforcement – that starred in the early part of this century, we are now increasingly looking to technology to solve our problems of speeding, driving while impaired, and distraction. Technological innovations are a rapidly growing part of the arsenal of crash countermeasures and driver assistance systems designed to keep drivers safe in their lanes with safe headways to vehicles and obstacles ahead. But the acceptance, use, and utilization of the new technologies are human behavioral issues that are discussed throughout the book. And as always with people, when their environment changes, it is naïve to assume that "all other things" will stay the same. Behavior will not, and this is illustrated in current research on driver adaptation to new support systems.

Two issues that were hardly addressed in the first edition were bicycling and the emergence of autonomous vehicles; going back to basics (locomotion through pedaling) on the one hand and jumping into the future (commanding the car) on the other hand. Increasing congestion, the desire for environmental sustainability, and renewed interest in health have catapulted bicycling to the fastest growing mode of travel. Bicycling and the interactions of bicyclists with the rest of the traffic – drivers and pedestrians – have spawned many studies that are now discussed in a dedicated chapter on bicycling behavior and safety. A special emphasis in this chapter is how to integrate cyclists into the traffic system while ensuring their safety.

The second new issue is that of the autonomous vehicle. Though autonomous vehicles had been considered nearly a century ago, at the dawn of this century it was still, for most people, a speculative issue worthy of discussion by futurologists. But the vigorous entrance of high-tech companies and automotive manufactures into this arena have made the autonomous vehicle a reality that could change our mobility and life patterns as much as the introduction of the combustion engine changed it a century ago. Contrary to "common sense" the autonomous vehicle does not make driving a non-sequitur. Instead, the expected need of human control and rapid intervention in unforeseen critical situations make this a complex issue as far as human-vehicle interactions

(and distraction) are concerned. This has significant implications for injury reduction and crash prevention, which are discussed in the last chapter.

Two significant research methods have contributed greatly to new knowledge and new conclusions concerning driving behavior and traffic safety: the use of naturalistic driving studies (NDS) and the technique of meta-analysis (MA). NDS is the ultimate ecologically valid study of road user behavior because it tracks road users as they move through traffic in their own vehicles going about their own business. Meta-analysis is a technique that synthesizes the results of multiple studies which have addressed the same issue using similar methods and outcome measures, to provide a robust measure of an effect or a countermeasure. As often happens in empirical research, the application of these methods – in different domains – either confirmed previous tentative less robust conclusions or actually debunked earlier misconceptions. The two techniques are described in Chapter 2, and results from their applications are evident in nearly every chapter of the book. Perhaps the most important finding from NDS, is the most recent conclusion emerging from the largest of its kind ever study of crash causation that demonstrated that even today the human factor is a critical element in over 90 percent of traffic crashes (Dingus *et al.*, 2016). In a way this provides prima facie justification for this updated text.

This second edition has the same organization as the previous one, but every chapter has been expanded to include the current relevant issues and the theoretical and empirical research to substantiate them. This edition has over 100 tables and over 200 figures, and cites over 2,500 research papers. Yet even this compendium of approximately 1,200 pages only provides a sample of the studies in this domain. The second edition provides updated research that supports and augments our knowledge of safety-relevant human limitations and capabilities (e.g., in terms of visual perception, and information processing), discusses new research methods and new findings that challenge our previous assumptions and conclusions (e.g., the nature and role of distraction, the risk of drugs, and the safety of older drivers), and discusses new topics that a decade ago did not seem as important (to me at least) as they are today (e.g., bicycling behavior and safety, and in-vehicle driver assistance systems and the autonomous vehicle). For this edition, I have significantly expanded all the chapters of the previous edition and added a chapter on bicycling. Although in the process some of the material of the previous edition was deleted, the new edition is still 50 percent longer than the first edition.

A work of this scope is rarely done without help, and this case was no exception. I would like to thank Tamar Ben-Bassat, John Eberhard, Tsippy Lotan, Ilit Oppenheim, Mike Perel, Edna Schechtman, and my wife Eva Shinar for reading and commenting on the drafts of one or more chapters. They were instrumental in forcing me to clarify some points and in uncovering and helping me correct multiple typographical, syntax, and substantive errors. The ones that remain are obviously mine to own. Finally, I thank the staff of Emerald Publishing, in particular Cristina Irving Turner, Emma Stevenson, Charlotte Hales, Nicki Dennis, and Jen McCall. Their consistent support over the past 3 years made this volume a reality.

References

Dingus, T. A., F. Guo, S. Lee, J. Antin, M. Perez, M. Buchanan-King, and J. Hankey (2016). Driver crash risk factors and prevalence evaluation using naturalistic driving data. *Proc. Natl. Acad. Sci.*, *113*, 2636-2641.

Njord, J., and K. Steudle (2015). Big data hit the road: The first year of use of the SHRP 2 safety databases. *TR News*, 300, pp. 3-8, November-December. Transportation Research Board, Washington, DC.