Improving Traffic Safety Culture in the United States

The Journey Forward

Safety Culture

What is it?
How can we measure it?
What can we do to change it?

AAA Foundation for Traffic Safety
607 14th Street, NW, Suite 201
Washington, DC 20005
800-993-7222
www.aaafoundation.org

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About the Sponsor

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Preface

J. Peter Kissinger

As a traffic safety professional, I know that roughly 43,000 Americans are killed each year in traffic crashes, and that traffic crashes are the leading cause of death for children, teens, and young adults in this country. It is quite simply what motivates me, and my associates, each and every day, to learn more about what can be done to reduce this public health crisis. Unfortunately, I do not believe the average motorist in this country appreciates the full implications of these tragedies.

I know that over the past several decades the traffic safety community has been successful in substantially lowering the risks associated with motor vehicle travel. But, I also know that over the past decade progress has slowed, despite the fact that much research suggests that we could probably cut this toll in half or better if only we would implement a few proven lifesaving countermeasures that we already know about. So, why don't we?

That is the central question that emerged from a two-day workshop of nationally recognized traffic safety experts convened by the AAA Foundation for Traffic Safety to consider a long-term traffic safety research agenda.

What we heard, over and over again from the group, was that we as individuals, and our society on the whole, are simply way too willing to accept the toll from these traffic crashes, apparently as an inevitable consequence of the mobility we enjoy.

At the same time, contrast this apparent "complacency" with what has happened since September 11, 2001. Americans have accepted the expenditure of billions upon billions of dollars to combat terrorism, and have accepted innumerable inconveniences and intrusions into their privacy that previously would have been considered unacceptable. When we get "outraged" about something, our society can marshal the requisite resolve and resources to make a difference!

Although the U.S. has improved traffic safety in many ways, we're not doing as well as many other countries. Prior to the mid 1960s, the U.S. enjoyed the greatest level of traffic safety in the world by any measure; whereas today, the U.S. has fallen behind most of Western Europe in terms of fatalities per mile driven, and ranks near the bottom of the OECD in terms of traffic fatalities per capita. The evidence suggests that these countries have achieved—and are still achieving—greater safety gains than the United States. Experts believe this is because they are willing to set more ambitious safety performance goals than we are, and because they are willing to do more to achieve them.

In this country, the official safety performance goal of the U.S. Department of Transportation is to reduce the motor vehicle fatality rate to one fatality per 100 million vehicle-miles of travel by the year 2008. The most recent statistics reveal that the U.S. has just seen its first increase in the fatality rate in two decades. We are no longer moving in the "right direction" too slowly—as we had been for the past decade—now, we're moving in the wrong direction. Moreover, even if we were to achieve the stated goal, that would still have us writing off roughly 30,000 annual deaths on our roads as the socially accepted price of our mobility, and that's before accounting for the projected travel increases.

Again, this provides a stark contrast to the picture in much of Europe and Australia, where motor vehicle traffic injuries, deaths, and rates of both, have dropped substantially over the past decades; where the target is a safe system that minimizes opportunities for crashes to occur and virtually precludes disabling or fatal outcomes by limiting crash severity; and where the measuring stick is the actual number of traffic casualties, rather than a rate that accepts the notion that increases in driving must lead to increases in crashes, injuries, and deaths.

To make real progress, which other countries have demonstrated is indeed possible, we need to transform our way of thinking. **We need to transform our culture**, from a culture that accepts loss of life and limb as a price of mobility, to one in which elected officials, transportation professionals, and individual citizens expect safety, demand safety, and refuse to accept that an annual casualty count roughly equal to the population of Arkansas is a fair price to pay for mobility. Until this happens, many safety measures known to work will remain unimplemented, with their lifesaving potential unrealized. We need to treat traffic safety with seriousness commensurate with the scope of the problem that it is. We need to get "outraged!"

We hope this compendium is a start along this new path. The AAA Foundation for Traffic Safety has made a long-term commitment to focus its research program on "traffic safety culture." As discussed in the various papers in this report, we are hoping to learn much more about "What is safety culture?" "How can we measure it?" And eventually and most importantly, "What can we do to change it?" We are also hoping that it will lead to an increased national dialogue about this issue, and most importantly, a new culture that is unwilling to remain complacent! Working together, we can and will make a difference!

Biographical statement

J. Peter Kissinger has over 30 years of progressively responsible experience in transportation safety. He has been President and CEO of the AAA Foundation for Traffic Safety since May of 2002. The AAA Foundation is a not-for-profit affiliate of AAA and the AAA motor clubs that supports research and develops educational products to enhance traffic safety. Other relevant experience includes ten years with the Civil Engineering Research Foundation where he managed "Innovation Centers" that evaluated new technologies for the public works and transportation community, and eight years as the Managing Director of the National Transportation Safety Board. Previously, he served as a Transportation Safety Specialist with NTSB, conducting evaluations of transportation safety programs, and an Operations Research Analyst with the U.S. Coast Guard where he evaluated proposed Federal safety standards and managed a research and development program. He has an MS in Operations Research from George Washington University and a BS in Engineering from the U.S. Coast Guard Academy.

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We would also like to thank the Federal Highway Administration and the National Highway Traffic Safety Administration for cosponsoring the October 2005 workshop that gave rise to our focus on safety culture.

Introduction

Many officials from the traffic safety community believe that to achieve substantial reductions in motor vehicle crash related casualties, our own way of thinking presents both one of our most formidable barriers and one of our most promising opportunities. In October 2005, the AAA Foundation hosted a workshop, cosponsored by the Federal Highway Administration and the National Highway Traffic Safety Administration, to identify and prioritize long-range traffic safety research needs. A recurring theme throughout the workshop was that one of our greatest challenges wasn't a specific traffic safety issue, but rather our way of thinking about all of the issues, or our "safety culture."

Following the workshop, the AAA Foundation made "Safety Culture" one of our four priority areas for sustained research and educational efforts. The overarching goal of this program is to ignite and sustain a serious dialogue about and demand for traffic safety at all levels of our society, elevating traffic safety on the national agenda to a place commensurate with its public health impact.

Recognizing that we would not be able to make a paradigm shift happen by ourselves, we began by soliciting input from the community regarding what "safety culture" is, how it can be defined or measured, and most importantly, how it can be improved. During February, March, and April 2006, we actively sought input from the traffic safety community and others, in the form of brief concept papers describing directions for the AAA Foundation and/or the community at large to take to promote change. Authors of several of these concept papers received in response to that solicitation were invited to develop their thoughts further, resulting in the papers in this compendium.

All of the papers in this compendium focus on the general theme of "culture" in the context of motor vehicle traffic safety. As you will see, there is considerable variation in the scope and focus of individual papers, as well as the perspective from which they were written.

For example, the paper by Larry Lonero describes what a paradigm shift in road safety might look like, and provides some examples of "potentially catalytic steps" to provoke discussion. Another paper by McNeely and Gifford draws from experience in three other culturally defined problems to provide insights that could be applicable to traffic safety. The paper by Wiegmann, von Thaden, and Gibbons reviews the concepts and definitions of "safety culture" that are used in other high-risk industries, and discusses the potential applicability of these concepts and definitions to traffic safety. Several of the papers discuss the role of culture in determining how people drive and suggest various avenues to promote safer driving cultures. Others focus on the policies and practices of various types of stakeholder groups that can influence traffic safety and provide suggestions regarding how they might be made more consistent with the respective authors' visions of cultures of safety. The wide array of issues—drawn from diverse perspectives—includes safety management, risk communication, the training of our safety workforce, and the importance of monitoring public perceptions of safety issues, just to name a few. Papers authored by top experts from Australia and the Netherlands add international perspective as well.

This document is being distributed electronically and in hardcopy to a broad cross-section of the traffic safety community. Through this compendium, the Foundation is providing contributing authors with a venue to communicate their perspectives on where we are with respect to the safety culture of our society, and more importantly, how to move forward. To that end, we hope the publication of this compendium, and the ideas that it contains, will lead to vigorous and sustained dialogue in the traffic safety community and beyond, and that it will ultimately lead to real change.

In addition, we at the AAA Foundation for Traffic Safety hope to initiate research and development projects over the next several years on “traffic safety culture” to learn as much as we can about what it is and how it can be improved. Most importantly, we are hopeful that these activities will ultimately lead to real world change—an enhanced “culture” that leads to fewer crashes, injuries, and fatalities on our roads.

Finding the next cultural paradigm for road safety

Lawrence P. Lonero

Dilbert: What was that popping sound?

Dogbert: A paradigm shifting without the clutch.

Scott Adams (1997)

Overview

Cultural paradigms determine both how we view road safety and the actions we take to improve it. While there may be many different competing paradigms for dominance, one paradigm can be seen as dominant. The dominant paradigm has changed a number of times over the century of motorization. The Finnish scholar, Valde Mikkonen (1997) has characterized conceptual development in road safety as a slow evolution punctuated by brief revolutions, which he sees as leading to a new dominant paradigm.

The 1960s paradigm shift

A paradigm shift of earthquake proportions that took place in the 1960s is responsible for the current high level of road safety in U.S. and Canada. A number of developments prepared the way for a major shift in thinking and action. Roadway development had made great progress, with the birth of the Interstate system. Cars had made technical advances in style and comfort, and especially engine performance; the mid-60s muscle cars still stand among the fastest production cars. The straight-line acceleration of these cars was not, however, well balanced with overall engineering sophistication, especially in terms of occupant protection. Also in the 1960s, emerging fuel economy concerns led to new lines of compact cars, which were even less safe.

The 1960s paradigm shift was also facilitated by some basic theoretical and scientific developments following World War II. A number of new and improved intellectual tools contributed to the shift, including systems analysis, decision theory, and epidemiology. The human factors engineering that developed out of military aviation during the war and the innovative biomechanics work of Hugh DeHaven and Col. John Stapp were also critical.

These intellectual fundamentals might have remained academic, except for the political agitation of consumer advocates; it is clear that even solid knowledge, well-founded theory may not be acted upon if contrary to the dominant paradigm. However, in the mid-60s, Ralph Nader focused attention on deficiencies of the Corvair, one of the new compact cars. This led road safety on to the public and political agenda, greatly aided by publicity resulting from the bungled attempt of a major auto builder to discredit Nader personally (Albert 1997).

In addition to pointing out the failings of the primitive automotive engineering of the times, Nader's book, *Unsafe at Any Speed* (1965), addressed the relative merits of vehicle-focused and human-focused approaches to safety:

> *... our society knows a great deal more about building safer machines than it does about getting people to behave safely in an almost infinite variety of driving situations that are overburdening the drivers' perceptual and motor capacities. In the twenty to forty million accidents a year, only a crashworthy vehicle can minimize the effects of the second collision. Vehicle deficiencies are more important to correct than human inadequacies simply because they are easier to analyze and remedy. And whether motorists are momentarily careless or intoxicated, or are driving normally, when they are struck by another vehicle is entirely irrelevant to the responsibility of the automobile makers to build safer cars* (p. 186).

The motor vehicle industry's reaction to this view can be summed up in the following comment from Henry Ford II, Chairman of Ford Motor Company, to a biographer then working on a book about the Ford family:

> *I'll tell you what I want you to put in your book about Nader. You say, from me, he's full of crap. … Look, we could build a tank that would creep over the highways and you could bang 'em into each other and nobody would ever get a scratch. But nobody would buy it either. We'd last about two months putting out stuff like that. The American people want good cars, good looking cars, fast cars, cars with power and styling, and that's the kind of cars we build. We spend a hell of a lot of time and money trying to make them better and safer, and then some pipsqueak who doesn't know a thing about the industry, comes along and tries to tell us how to do what we've dedicated our lives and billions of dollars to doing* (In Lacey 1986, 580).

The public and political weight came down on the pipsqueak side. Dr. Bill Haddon, as director of the nascent National Highway Safety Board, applied the epidemiology model from public health, and this model also led to a focus on occupant protection. This focus led in turn to technology-forcing regulation addressed to the car builders under the U.S. and Canadian Motor Vehicle Safety Acts and, in the U.S., federal standards for highway improvements and some driver oriented programs. Later unravelling of the federal driver-oriented standards was recently outlined by Brian O'Neill (2005). Without the driver component, the dominant paradigm focused largely on occupant protection. Although this paradigm has been seen by some as too narrow (e.g., Evans 2004; O'Neill 2005), it has been very successful (e.g., Farmer and Lund 2006). The improvement in fatality rates has been so great that there has been a reduction in the absolute number of fatalities, compared to the peak numbers in the mid-1970s, despite huge increases in travel. Despite initial reluctance and skepticism, the car builders and state highway authorities rose to the challenge, and the resulting safety improvements have been recognized as one of the leading public health accomplishments of the 20th century (Jones et al. 1999). Going beyond simply responding to regulatory pressure, the car companies and their parts suppliers have become highly innovative, and safety features have become a competitive factor in vehicle sales —putting the lie to old wisdom that "safety doesn't sell."

This history provides an important lesson about the importance of science, as well as broader culture factors on road safety. Scientific knowledge and theory can identify potential innovations, but what we can actually do depends on the dominant paradigm, which also includes economic,

political, and bureaucratic interests. Set patterns of thought and action persist until sufficient weight of influence forces a paradigm shift toward a better model or theory. As Scott Adams pointed out, the shifting of paradigms is not quiet or comfortable. It is difficult enough for individuals to change how they think, but it is especially disruptive to change the organizations that have been structured around an old paradigm. Powerful interests invariably develop around established ways of thinking and doing things, and it is painful to have to change them.

It is an ironic sidelight that, as passenger cars reached a remarkably high level of safety and efficiency by the end of the 20th century, half the personal vehicle market shifted over to less-safe light trucks and sport utility vehicles (SUVs). Somewhat reminiscent of Ralph Nader's efforts in the 1960s, Leon Robertson (1997) and others have criticized manufacturers and federal regulators because of a tendency for some of these vehicles to roll over and injure their occupants. SUV design has developed rapidly to address these concerns, and increases in fuel prices seem to be reducing demand, at least for larger SUVs, at the time of this writing. However, utility vehicles seem to be better suited to North American automotive culture than are modern sedans, for which the ideal model seems to be the Autobahn-oriented European sport sedan. North Americans typically drive relatively slowly on wide, straight roads, and they often carry or tow great quantities of personal goods, so SUVs and trucks as personal transport are probably here to stay. In the current paradigm, the manufacturers should be required to make them as safe as cars. A new paradigm would require drivers to be equal parts of the safety solution, perhaps also requiring that drivers be properly prepared for use of the full range of vehicles and of new highway and vehicle technology as it comes into use.

Former NHTSA administrator, Martinez (2000), said that the easy safety gains from occupant protection have now have been largely realized, suggesting that major additional gains from passive occupant protection may be progressively more difficult and expensive in the future. If this view were not unduly pessimistic, an immediate paradigm change would be needed to focus on crash prevention, either through vehicle and highway technology or through alteration of driver behavior. Clearly, however, the pessimistic view of the future benefits of vehicle technology is wrong, as occupant protection technology in new vehicles is still improving. Furthermore, even if cost-effective occupant protection innovation eventually plateaus, it will still take many more years for the existing fleet of vehicles in use to be replaced so that most vehicles on the road have all the latest occupant protection features.

Relative to occupant protection technologies, in-vehicle crash avoidance technology is relatively new and unproven. An early attempt (ABS) was not, at least initially, very successful, probably because of how unprepared drivers interacted with the technology. On the other hand, electronic stability control (ESC) shows highly promising effects (IIHS 2006), and a host of crash detection and avoidance technologies are in the development pipeline. It will be another generation until occupant protection and crash avoidance technologies, even those we can envision today, are mature and deployed throughout the vehicle fleet. We could wait until that happens until trying to force a paradigm shift toward effective behavioral programs. Better, we could recognize that more effective behavioral approaches could be preventing crashes and saving lives now, and eventually it will be absolutely necessary for drivers to contribute more if safety improvement is to continue. However, acting on this recognition would require a paradigm shift much more controversial and uncomfortable than the 1960s shift. A new paradigm that tries to make drivers part of the solution would require changes in legal culture, media culture, and driving culture, rather than putting the whole responsibility on a few car companies and highway authorities.

Legal culture in road safety—regulating the freedom machine

Law has always been a fundamental part of the cultural paradigm for road safety. In principle, law expresses society's values and expectations. For road safety, it lays down the formal rules for use of the public roads and structures organizational responsibilities and powers. While law typically reflects past culture, it occasionally attempts to lead to new actions and perspectives, as was the case in the 1960s paradigm shift.

Despite its importance, relatively little legal theory has appeared in the road safety literature. Mashaw and Harfst's (1990) book suggested there has always been a profound ambivalence about regulating "the freedom machine," the private car. They recognized that vehicle regulation was the dominant paradigm after the '60s but suggested that it slipped in the 1980s back toward earlier, "discredited" behavior change strategies, such as driver education. "These projects do not appear to have much effect on safety, but they fit the culturally approved paradigm of automobile law" (p. 231). There may have been a lull in new vehicle standards and rule making, but there was clearly no great movement to support driver oriented initiatives. Actual support for driver education in particular was greatly reduced during the '80s (Lonero et al. 1995), although the common rhetoric that education is the only solution to road crashes no doubt continued unabated.

Canadian legal scholars Friedland and colleagues (1990) contrasted their view of traditional legal culture with the epidemiological approach. Law seeks out and punishes fault or "blameworthy behavior." The scientific, epidemiological approach seeks whatever changes will be most effective in reducing injuries. Legal scholars have not only expressed concerns about the focus on single causal factors and fault in the law but also what Kent Roach (1999) defines as the "criminalization of politics." This occurs when the criminal sanction is offered as the primary response to issues that have complex and multiple social, economic, cultural and other factors. New crimes such as impaired or dangerous driving causing death may be presented as simple solutions to traffic safety that is much more complex. Roach saw a danger that justice agencies will not engage in adequate coordination with transport, consumer, and health agencies whose policies have effects on traffic safety. This tendency could resuscitate the much earlier "nut holding the steering wheel" paradigm, which may be reflected in recent concentration on deviant drivers and aggressive driving. Despite the rhetoric addressed to deviant drivers, many jurisdictions have actually cut back on proven driver improvement programs in favor of cheaper diversions into violator schools.

Civil liability, operating through insurance premiums and incentives has been suggested by Lawrence Ross (1991) as a possible area of future promise for influencing driver behavior. The incentive effects of the threat of civil liability have, however, probably been diminished by nofault insurance (Cummins and Weiss 1999). Ross also suggested a renewed focus on licensing, such as graduated licenses. GDL has been widely implemented and shown measurable effectiveness—a rare bright spot in driver regulation.

For use of the public roads, legal theory accepts restrictions on liberty, such as requirements to use seatbelts, which might not be acceptable elsewhere. Implied consent laws require drivers to give up incriminating evidence, such as breath samples for alcohol analysis. Whether driving on the public roads is a privilege or a right has been subject to a long and rather fruitless debate (Reese 1965). Driving is more plausibly seen as a right with limits—no right is absolute, without

limits. Calling driving a privilege was apparently thought to influence drivers to behave properly to "earn" the privilege. This old language debate is similar to the modern one, in which most safety experts stopped using the word accident, supposedly to motivate the public to take more responsibility for avoiding "crashes," rather than accepting unavoidable accidents. There appears to be little evidence that these language shifts have any effect beyond providing diversion to experts waiting for ideas and opportunities to undertake more substantive interventions.

More contentious currently are issues of privacy, which are used as arguments against automated enforcement, such as red light cameras. A related developing issue is whether enforcement authorities and litigators should have access to data from onboard data recorders present in many recent vehicles.

Despite difficulties and uncertainties, legislation provides an important foundation for the management of road safety. Legal theorist Bonnie (1985) noted the great behaviorist B.F. Skinner's idea that rules are society's way of telling its citizens how to learn from the mistakes of others. This is necessary because people do not directly "experience the risks evidenced by accident statistics. Individual levels of perceived risk are low" (Rumar 1988, 507).

Mashaw and Harfst (1990) suggested finding new market regulation strategies to advance road safety at the individual level, such as incentives which are less abrasive to personal freedom than bureaucratic regulation. They concluded, "The relentless pressure of well designed economic incentives is, as Adam Smith so aptly put it, invisible" (p. 243). Of course, psychologists have also called for incentives (Wilde 1994).

Mashaw and Harfst also pointed out a number of lessons for regulators, suggesting that a "top-down," science-based approach ignores politics and the inertia in legal culture. Health and safety regulators have few reliable allies, and public support is "widespread, but very thin." Citizens favor health and safety but not restriction of freedom or comfort. Mashaw and Harfst suggested that education about regulation is hard to get to the public because competent, effective regulation is not news, while "bureaucratic bungling, villainous behavior, and dangerous defects" make entertaining copy.

Contingencies might be arranged to induce lower-tier governments or other institutions to develop more effective programs. The U.S. federal government has the authority to coerce the states, while the Canadian government does not. This authority permitted the U.S. federal government to require states to achieve certain levels of compliance with the national speed limit and to raise the legal drinking age to 21. Influence might be more acceptable if structured as a positive incentive rather than a threat of withdrawal of funding, as might be argued in the U.S. examples, although this theory has not yet been proven. Brian O'Neil (2005) identified the lack of use of federal authority to require states to develop more effective programs as one of the major failures in road safety in recent times. In societal or cultural terms, it may come down to what is more highly valued, the inviolable autonomy of the states and provinces to keep operating weak programs, where most of the driver regulation takes place, or a few thousand crash deaths more or less. A major new U.S. transportation bill (SAFETEA-LU) passed later in 2005 again provides incentives for various state safety programs and for more comprehensive strategic planning at the state level (FHWA 2005).

While the leverage of laws is critically important, laws directed to drivers do not always have the desired effect (e.g., McCartt and Geary 2003). In unskilled hands, the law is a blunt weapon and also a rather fragile one. In the popular conception, "If there is a problem, pass another law" seems to be the reflexive reaction to most concerns. In fact, law must be implemented very carefully if it is to be (and remain) effective, and if it is not to cause unmanageable problems of resource demands in enforcement, courts, and corrections (Carroll and Solomon 2000; Lonero et al. 1994). This is particularly true where the requirements of the law run counter to dominant cultural practices.

Visible enforcement on the roads has long been considered a critical basic support for road safety. However, naturally occurring quasi-experiments, such as police strikes and enforcement blitzes, suggest that modest changes in the amount of enforcement have little direct, immediate impact. In their overview of the enforcement evaluation literature, Bjornskau and Elvik (1992) concluded that the effects of enforcement are local and transient in nature, and that no studies show that traditional enforcement alone produces a permanent change in violation rates. Bjornskau and Elvik's meta-analysis of speed enforcement studies pointed out a particularly interesting finding in a pair of Swedish studies. There appeared to be a threshold of noticeability and effectiveness if enforcement increased between 3 and 5.5 times the base level, smaller increases went unnoticed.

Clearly, short-term changes in enforcement have to be substantial and well publicized to be noticed by drivers—in the short term. Nevertheless, short-term effects may not reflect possible long-term effects. Typical evaluation studies cannot assess effects of different levels of enforcement intensity on drivers' expectations and habits over the long term (Lonero et al. 1994). It is possible that our relatively orderly driving culture in North America results partly from past enforcement levels, however modest they may have been.

There currently is little tracking of enforcement changes across time or across jurisdictions, but there is reason for concern that traffic enforcement has declined in recent years. Ontario saw a 45% drop in convictions registered annually between 1988 and 1996. If the conviction rate had stayed at 1988 levels, there would have been over 650,000 more convictions in 1996. Ontario was not alone in this trend. In some states, convictions registered in driver improvement systems have declined. In California, convictions registered in the driver improvement system declined by about one-third between 1991 and 1994 (Peck and Healy 1995). An NHTSA-sponsored study of eleven police agencies suggested an overall decline of tickets written activity, although county sheriff departments produced increases (Wiliszowski et al. 2001). If there has been a sustained decline in enforcement in North America, its consequences may be reflected in the simultaneous growth in concern about increases in aggressive driving, although it is not clear if such an increase has actually taken place.

A perspective on the role and limitations of enforcement, as well as a direction for improving it, come from the seemingly unlikely direction of game theory (Bjornskau and Elvik 1992; Kim and Kim 1997; Tsebelis 1989). Game theory is a special type of mathematical decision theory that describes how change in the behavior of one player influences the optimal strategy of the opponent and leads to changes in the opponent's behavior. For instance, if more drivers speed, more enforcement might be applied. If effective, the additional enforcement would cause fast drivers to slow down. Then enforcement would be reduced, diverted to other duties because of the lower perceived benefits of speed enforcement. With less enforcement, speeding would increase again. The game model shows that rational, predictable behavior can lead to less-than-

optimal safety outcomes. Tsebelis (1989) suggested that incentives or disincentives *for enforcement authorities* must be altered in order to permanently change drivers' behavior. It would require a broader paradigm to apply organizational incentives to police and other agencies.

While deviant drivers contribute a very small part of the whole crash problem, the crashes of identifiable bad and outright criminal drivers are both frequent and especially severe. These crashes may also be less acceptable culturally than those caused by the occasional errors of normal drivers, although the victim may be just as dead. In a similar way, injury by "deliberate" violent means, such as assault, appears to be more feared than injury by the violence of a motor vehicle "accident." Nevertheless, a balance of concern for the crashes of both "good" and "bad" drivers needs to be part of a new cultural paradigm.

The enforcement, adjudication, and administration of traffic laws have changed substantially in recent times. Diversion moves traffic offenders away from courts and state driver improvement actions into violator schools or other local programs. These diversions seem to mean that traffic law no longer has sufficient priority to warrant the required expenditure of resources. Courts and municipalities have "voted with their feet" against legal penalties and administrative licensing sanctions for violators. As fatalities declined through better cars, roads, and medical intervention, the withdrawal of driver-oriented legal measures may have been considered justified. In the longer term, however, the impacts of law on driver behavior will need to be improved. A new, more comprehensive paradigm will be needed to restructure organizational incentives and raise the level of coordination necessary to achieve an improvement in driving culture and the way people actually drive.

Driving culture and the media

Driving behavior is powerfully influenced by driving culture—that is, the common practices, expectations, and informal rules that drivers learn by observation from others in their communities. Driving cultures vary among regions and communities. On and off the roads, drivers are immersed in information about driving and related matters daily. Driving information is buried in the media buzz of information about thousands of issues and events.

Driving-related information in the media comes through:

- Explicit advertising messages, whether paid or public service.
- Deliberately placed public relations, by commercial businesses, trade and lobbying groups, and not-for-profit public service organizations.
- Multi media campaigns.
- Routine news coverage of collisions, technical developments, legislative and regulatory matters, litigation, and political and fiscal matters.

Ideally, the media would provide people, both as drivers and citizens, with a steadily growing insight to support more rational decisions and reinforce road safety values. We are still a long way from having communications media that consistently provide positive support to safe and healthy driving cultures. Changes are taking place, however, as mass media "… encompass more

interactive features of the local environments and 'media advocacy' as a means of mobilizing social and political support for policy and regulatory changes…" (Green 1999, 78).

Much effort and resources have been expended to deliberately influence drivers' behavior through paid or public service advertising and public relations approaches. While they may make us feel better that "something is being done," isolated, sporadic "awareness campaigns" probably have objective value only as public relations for their sponsors. A review of research on methods of influencing behavior (Lonero et al. 1994) concluded that public education and advertising promotions typically have little effect on their own, in terms of directly influencing drivers' behavior, but they have a strong role to play in broader programs, such as in support of community-based selective enforcement. There can may be important indirect effects, at least when communication is concentrated and prolonged. Communications researchers (Yanovitsky 1999) found that the huge volume of anti-DWI promotion in the media during the 1980s was effective, but the direct effect was on politicians and bureaucrats who changed laws and programs, which in turn affected driver behavior.

There is a clear need to strengthen the role of safety organizations and media in educating drivers and other road users. The most successful approaches may require a "backing up" to set preconditions for progress. Preusser and Blomberg (1984) wrote, "The process of generating a public education countermeasure idea and then transforming that idea into messages that yield an accident reduction is complex and highly uncertain" (p. 48). However, they developed a successful mixed media program for young pedestrians using an explicit stepped process, requiring intermediate assessment at each step. This successful pilot program was never followed up.

A great deal of study has gone into trying to identify the factors that make a media message effective. In a review of the effects of media communication on health and safety habits, Wilde (1993) categorized four principal elements in mass media communication and the critical factors that determine effectiveness, as follows:

1. The source—Credibility, expertise, trustworthiness, and similarity to the recipient.
2. The content—"Distance" from recipient's views, positive message first, concrete effectiveness, personally relevant, modelling and imitation, arousing attention, motivating appeals, not humor or fear.
3. The channel of communication—Rates of exposure, immediacy to targeted behavior.
4. The recipient—Self-selected exposure, opinion leaders or followers, conspicuous target behavior, multi-stage communication through personal influence, persuadability, or reactance.

While specific attempts to influence behavior through the media are uncertain of success, it is clear that media communications have important effects. Media may not tell us what to think, but they can establish agendas, influencing *what we think about*. Wilde (1993) conceives of the media audience as "active decision makers," rather than "passive message absorbers." The more broadly the media inform people on an issue, the more likely they are to make sensible decisions with respect to that issue. This suggests public education should be different from tradition—much richer, better informed, more extensive, more informative, and less directive if it is to be part of a new cultural paradigm.

In addition to targeted public education, reporting in the news media is part of the information culture. An extensive pilot study has shown considerable untapped potential for safety benefits in the news media. Wilde and Ackersviller (1981) experimentally altered the newspaper treatment of local collisions in Kingston, Ontario. More information was presented, along with the human interest context of the crash. A series of feature stories conveyed general safety information. Surveys showed that public perceptions of road safety in Kingston had changed. No change was seen in a control community. This approach has potential for improving knowledge and raising road safety on the agenda of public concern. Again, a highly promising pilot program has not been followed up. To remedy this, Lonero et al. (1994) suggested recruitment and training of media to improve the superficial coverage of road safety. Proposals to implement this suggestion have not yet been supported.

It is important to have people become more concerned about road safety both as citizens and as drivers. As citizens, they may become more supportive of effective legal and policy actions, and demand demonstrated effectiveness in programs. However, by itself, more concern for road safety will not necessarily improve drivers' behavior on the roads. Tyler and Cook (1984) showed that even conventional media coverage influenced risk-related judgments. The resulting increases in peoples' judgments about risk, however, were at a societal level rather than the personal level. That is, people seem to feel, "It is a big problem, but it's not my problem." Wilde and Ackersviller found a similar effect. Unless there is a reason to identify with a problem, people prefer to think of it in general terms, removed from their personal concerns. This may help explain how information programs can change attitudes toward legislation, without changing behavior, as occurred in Ontario before the introduction of seat belt legislation (Lonero et al. 1994; Lonero and Pierce 1981).

A novel approach to media was developed by the government insurance company in Victoria, Australia. Due to weak evaluation reporting, it offers more promise than proven success. The approach, referred to as "marketing traffic safety as a consumer product," used advertising as marketing, not as public education. It involved hard-hitting messages, targeted to specific behaviors, such as DWI. The program developers concluded:

> *All the evidence suggests that when the ads are off-air, the road toll goes up. And when the ads are back on-air, the road toll goes down. We are beginning to conclude that road safety is not a rational considered-purchase decision. Road safety is an impulse decision that requires constant, high, top-of-mind product promotion* (Forsyth and Ogden 1993, 1440).

The same effects could be understood, from a behavioral psychology perspective, as resulting from the ads acting as cues and prompts, reminding drivers in real time about behavioral alternatives and choices. Either way, the approach is worth further exploration, but this appears not to have happened.

Finding ways to personalize risk seems to be a key to media effectiveness in safety. Leiss (1990) suggested the relevance of the rapidly developing field of "risk communication," which is focused on informing people about health and environmental risks in general (Gerrard, Gibbons, and Resi-Bergan 1999; Rothman and Kiviniemi 1999). Risk communications normally take place between two disparate groups: 1) experts who have data about some sort of objective tech-

nical risk and 2) the media and general public who lack objective technical data but experience varying levels of subjective, perceived risk. Governments and safety organizations are positioned in the middle, facing both ways and trying to communicate in the language of both groups.

Media personnel have an enormous task to maintain sufficient knowledge in all areas of risk communications. But without some basic knowledge of content and statistical methods, reporters are unable to serve as an effective conduit for risk and safety information. This is as true in road safety as in other important risk areas, such as security and environmental threats. The difference with road safety is that commonness of experience may render the media less critical of information sources and of their own common sense understanding. Media personnel are mostly drivers, and what drivers do not think that they are, at least, minor experts on driving?

News media often focus on trends, either real or imagined, such as increases in road rage, without much understanding of what they mean or how they work. Mistakes can be made either by ignoring trends or assuming that they are more powerful than they actually are. Even a real current trend does not mean that everything and everybody is going that way, nor will an actual trend necessarily continue. Change is continuous and inevitable, but trends tend to be self-limiting or cyclical, so today's hot trend may be next year's old news. Road safety needs to be understood within a changing world and managed within a structure that is sufficiently knowledge driven and flexible to keep pace with a broad array of changes.

Geller (1998) uses the phrase "increasing actively caring behaviors" to reflect "both the ultimate goal and the fundamental challenge of a Total Safety Culture: where everyone must periodically go beyond his or her personal routine for the safety and health of others" (p. 274). The emphasis on culture is part of a broader trend, as other behavior analysts have come to address questions of how to build stronger, healthier cultural institutions in more general areas of social concern (e.g., Mattaini and Thyer 1996).

In a paper on behavioral adaptation to safety countermeasures, the OECD (1990) pointed out that negative, perverse effects of some measures are possible, making careful planning and empirical evaluation even more critical. Research and theory on behavioral adaptation to safety measures has continued (Jiang, Underwood, and Howarth 1992; Traynor 1993), although the concept remains controversial (Wilde 2001).

A more informed, sophisticated, and demanding public would be highly positive for road safety, while making life much more difficult for bureaucrats and politicians. Arguably, the highest-level driver skill is that of a concerned, active citizen, motivated and able to ensure that the driving world becomes a better place for mobility, safety, and equity. The principle of good regulation and good program management—that regulations and programs must be reasonable and effective—has been widely neglected. However, for our hypothetical future driver/citizen, political expediency, and common-sense ideas of "what ought to work" would not be good enough. In a new paradigm that really values quality and accountability, state and provincial governments would have to evaluate and improve their driver programs. Skilled citizen-drivers of the future would demand transparency, and they would be equipped to understand and *act upon* the unvarnished truths about road safety. As will be discussed later, telling the truth was proposed as an innovative road safety strategy by Frank Haight (1985).

The traditional bureaucratic constraints on the ability of governments to influence crash prevention through driver behavior must be faced and overcome. To facilitate this, organizational behavior change must become a legitimate area for study and action in road safety. Critical issues

are coordination, evaluation, and accountability in program management. Coordination is critical because the multi-causal nature of crashes requires multifaceted programs for effective change. Coordination of programs, however, runs against organizational boundaries and bureaucratic interests. Better safety management may depend on finding what organizations need to support their own specific objectives and providing it as exchange for the organizations' support of safety objectives.

Evaluation is critical for safety interventions. Interventions should be seen as experiments and evaluated as such. No program, however carefully planned, can be assumed to be effective without empirical data. If there is to be progress in safety management, it will be knowledge driven (Cirillo et al. 2000). The needed development of an expanding pool of knowledge for continued refinement of behavioral technology will only become available through objective, empirical evaluation.

Accountability for safety outcomes is critical because organizations, like individuals, will only change when change is motivated, enabled, and rewarded. The "payoffs" received by organizations with responsibility for road safety are rarely contingent upon success in reducing the severity of the problem. Transfer of program technology, coordination of multifaceted programs, and the evaluation and refinement of interventions will not likely occur more effectively in the future under existing organizational structures. Strategic reorganization and techniques of inducing organizational behavior change are needed for more effective road safety management.

Ivan Brown (1986) concluded an Ergonomics Society Lecture with this statement:

> *... our current problems in road safety seem largely institutional. … Road safety thus appears to have a low status among government policy makers and I can see little prospect of improving safety until this roadblock is removed.…* (p. 1503).

Brown pointed out the need for accountability for safety and, perhaps, a central agency, much like Frank Haight's call for a public health type of structure for road safety, clear of the conflicts inherent in transport departments.

The public seem to lack sufficient interest to process more than short sound bites and quick-fix simplifications. The media lack sufficient interest to provide critical analysis. In such a situation, transparency is not demanded and not offered by authorities. While there has been little study of the political science of road safety, one researcher pointed out that politicians and bureaucrats can use apathy to their advantage, proposing unchallenged, only vague reasons or explanations for actions, or for inaction (Koltzow 1993). The media and political oppositions seem rarely able to challenge on matters of road safety policy, planning, and effectiveness. For example, safety program plans often contain the word "hopefully" with respect to expected results, and typically have no objective evaluation component which could find out if the hope was fulfilled. Without evaluation, there can be little progress toward more effective programs. Without accountability, evaluation loses its potential impact.

Much knowledge now exists that is not used. We need to place a high priority both on accelerating generation of new knowledge and using all available knowledge to encourage safer driving culture.

What would a new paradigm look like?

The dominant cultural paradigm for road safety in North America has been one set in place in the 1960s. It is based on two key assumptions. First is the ability of federal technology-forcing regulation to require automobile manufacturers and highway authorities to continuously improve the protection of vehicle occupants. This assumption was initially highly controversial, but it proved to be correct.

The second key assumption is that prevention of crashes is impossible, at least as it is attempted through influencing how hundreds of millions of people choose to drive. This too has proven to be correct, at least in part. There have been spectacular successes in some safer behaviors—seat belt use and avoidance of DWI have become part of mainstream driving culture. However, influencing on-road driving behavior to any significant degree has remained elusive. It is probably beyond the ability of the diffuse, decentralized responsibilities within the states and provinces. Of course, no central authority has been requiring these jurisdictions to produce ever more-effective programs in order to stay in business. In fact, many driver programs are probably significantly weaker than they were decades ago. We need to ask why we require rigid compliance with performance standards on the part of the auto makers, while leaving drivers and the governments that regulate them to be largely self-regulating. We accept as normal in our cultural paradigm that nearly everybody will stretch the driving rules—for example, routinely driving well above speed limits.

About twenty years into the modern era, Frank Haight (1985) outlined a clear summary of received wisdom to that date and a six-component program to move road safety ahead. Broad strategic analysis is rare in this field, and Haight's short but highly astute paper stands as nearly unique for its time. Haight concluded with six prescriptions for progress:

1. Reorganize road safety under an independent public health type agency.
2. Plan for the long range.
3. Disengage road safety from public concern and public relations.
4. Commit to full truthful disclosure to the public and politicians.
5. Reorganize professional education and public information.
6. Formulate a coherent modern research program.

Significant overall progress is lacking in implementing these prescriptions. They require organizational change and a level of commitment and seriousness that has not yet been available politically, bureaucratically, or among the media and the public. Haight pointed out that scholars and researchers figured out, only about thirty years ago, that the crash problem was not going to be solved automatically and effortlessly. If we have learned anything in the years since Haight's trenchant 1985 insights, it is that the cultural paradigm is critically important.

From the perspective of another twenty years beyond Haight's 1985 attempt to reshape the road safety paradigm, a paradigm shift is even more clearly needed to guide road safety strategy and development. Road transport is entering an era of revolutionary development: partly driven by the need to make better use of a finite and mature roadway network and partly driven by the

convergence of new communications and transportation technologies. The advent of these new technologies, including Intelligent Transportation Systems (ITS) and Intelligent Vehicle and Highway Systems (IVHS), will lead to a major rethinking of road safety. These developments need to be enhanced, both for road safety and potential economic benefits.

The global scale of the road accident problem is now more apparent too. Almost 90% of road casualties take place outside North America and the other industrial nations. Taking leadership in road safety, within OECD, WHO, and other international structures, would be consistent with earlier tradition, and it would also probably help in setting our own house in order. Our dominant cultural paradigm, vehicle-occupant protection through vehicle and infrastructure technology, does not translate well to low- and middle-income countries, where most casualties are not vehicle occupants. Developing a leadership role relevant to global road safety could be set in motion by establishing the intellectual and organizational foundation for a more comprehensive, cultural approach to road safety. This is important for further improvement in the already relatively safe roads of North America, but especially important for the long term mitigation of the bulk of the global road injury problem. A new cultural paradigm must incorporate effective influence of road user behavior, both for our own long-term safety improvement and for leading improvement of the staggering global losses, now exceeding 1.2 million deaths annually.

Behavioral outcomes change when organizations, rules, and programs change, however uncomfortable it may be for the organizations involved. Incentives and disincentives for organizations need to be better understood and altered in order to permanently change drivers' behavior. It is recognized that it would require a very high level of commitment and management perspective to apply organizational incentives to organizations that hold the keys of program effectiveness, such as driver administrators, courts, and police agencies, but this commitment and perspective needs to be an explicit part of a cultural paradigm for road safety. The need for a comprehensive perspective has been recognized for a long time in some other fields, such as health promotion (e.g., Green and Kreuter 1991).

Road safety can benefit significantly from improved cooperation in R&D and harmonization of regulations and standards. This is clearest internationally but is a significant issue even nationally within the U.S. and Canada, with their highly decentralized responsibilities for road users and highly eclectic, diverse programs. With respect to safety programs and results, O'Neill (2005) suggested the states are more like 50 different countries. Cooperation in R&D and programs could greatly leverage the limited resources typically available in any one jurisdiction, but this is rare. Harmonization can introduce a wholesome discipline and force a careful look at practices and programs—something that has been sorely lacking among the states and provinces of North America. Even granting local differences in conditions, there probably are not 50 or 60 of effective ways to design and implement driver regulations and other safety programs. This is not to say that optimal programs cannot be modular, with some variation in components and emphasis. Indeed, with strong program evaluation and continuous improvement, local variation in programs would redevelop in a rational way, driven by innovation and effective results. With pressure to demonstrate objective success, some diversity would be healthy.

Our understanding of the forces and factors influencing road safety and the social, political, and economic context in which they operate is now more complex, more dynamic, and more comprehensive than in 1965, or even in 1985. It is safe to say that Ralph Nader's 1965 dogma,

"… our society knows a great deal more about building safer machines than it does about getting people to behave safely…" is less true. We now know a great deal more about influencing behavior (e.g., Lonero et al. 1994). Knowing is not the problem. Where little progress has occurred is in finding the political and bureaucratic will to develop and apply sound, evidence-based knowledge in operational programs addressed to how people drive.

The dominant cultural paradigm determines both how we view road safety and the actions we take to improve it. At the most fundamental level, road safety's cultural paradigm consists of *the implicit shared values and beliefs that determine the way in which the society organizes and acts to assure safe, sustainable mobility.* As Scott Geller has pointed out, safety is too important to be a mere priority, which is negotiable against other priorities. Rather, safety must be a value that is considered in all decisions as are other fundamental societal values, such as freedom and equity, and more recently, security. Bureaucratic turf protection and firewalls make life comfortable and rewarding for bureaucrats, but they impede society's ability to manage safety as a shared value. Failing to improve or reducing potentially cost-effective types of programs, such as driver improvement, can take pressure off some bureaucracies' budgets, but these actions create greater costs elsewhere. Weak programs, in effect, externalize costs of those bureaucracies on to other societal budgets, such as health care or insurance. Weak programs also waste resources that could otherwise be used for effective programs.

Certainly, there are many specific safety studies, projects, and reforms that are needed, but piece-meal solutions are not enough to create safe roads for the world. Both national and subnational levels need coordination, authority, resources, and accountability to energize operations and policy within diverse government agencies and among public and private partners. To shift to a more comprehensive paradigm in North America would require a stronger and longer-term vision of possible futures for safety because vehicle technology will keep saving more lives for many years. Some nations have taken a long vision, such as the Vision Zero target developed by Sweden. Closer to home, we tend to have either no targets or very modest targets that probably can be reached through the old paradigm and vehicle technologies as new vehicles improve and old vehicles are retired from the fleet. Success in implementing a new cultural paradigm for road safety could create world leadership and ensure the achievement of sustainable safe mobility on the roads of North America, and eventually for the world. North America's apparent apathy looks callous in light of the 1.2 million deaths per globally.

The new paradigm would:

- Recognize the cost of all crashes rather than just the fatality tip of the iceberg—taking action to prevent crashes, not just fatalities.
- Recognize the full cost of crashes that could have been prevented by better programs—balancing accounts for crash losses and program cost at the state or provincial level, as well as nationally.
- Recognize that road crashes are a major drag on national and world economies—money talks loudly and to everybody, not just those who feel concern for victims.

- Recognize that program costs flow out through transportation, enforcement, and other agencies, while losses (or cost savings from improved programs) accrue to health, insurance, and other sectors, and that these costs are not balanced under current safety administrative structures.
- Recognize that institutions originally developed as a solution can become part of the problem, if lacking vigorous leadership, vigilant oversight, and a demanding public and media.
- Make it self evident that targets for improvement should require real effort and the full use of relevant knowledge and resources.
- Focus on crash prevention through improvements in on-road behavior of drivers and other road users—concentrating on developing and applying the best knowledge.
- Lead responsible authorities to treat safety seriously as a value—not just giving lip service or going through the motions.
- Require all programs to be objectively evaluated and continuously improved—including driver programs.
- Make unacceptable the willful neglect of well-established knowledge—including the suppression of uncomfortable research and evaluation findings.
- Make obvious that responsibility for safety must be located at the highest level of governments—giving authority to force different agencies to work together toward common safety improvement targets.
- Insist on improvement of driver programs through technology-forcing regulation and incentives.
- Support movement to self-sustaining development and competition in safety program innovation among jurisdictions and responsible authorities.

What would it take to catalyze a paradigm shift?

Obviously, shifting the paradigm is a much taller order this time than it was in the 1960s. There has been enough safety improvement, through occupant protection and crash severity reduction, over recent decades that a certain amount of apathy toward road safety is publicly acceptable and politically expedient. From the perspective of the 1960s paradigm, the road safety battle is over, and we won. A new paradigm would say that the 50,000 or so North American deaths, the 1.2 million global deaths, and all the other crash costs, are still unacceptable. Clearly SAFETEA-LU represents a major investment for the U.S., but it remains to be seen whether its incentives and comprehensive planning requirements will catalyze a new way of thinking about the problem. Getting state and private organizations to buy into a new paradigm will be difficult because acting appropriately in line with such a paradigm is not easy. Many things will have to be done differently to bring drivers on board as part of the solution. Identifying all the specific steps that would help move us toward a tipping point and paradigm shift is beyond the scope of this short paper, and, perhaps, beyond the author's knowledge and vision. A few examples of potentially

catalytic steps are presented below, hopefully to provoke discussion and elaboration by those with different, and, again hopefully*, broader perspective and deeper understanding. Clearly, the present volume is a good step toward broadening our common understanding of the problems and potential further solutions.

A few examples of ideas for additional steps that might irritate authorities and the public sufficiently to start change include:

- Implement Frank Haight's suggestions from 1985—reorganize, plan long range, have courage in public relations, tell the truth, and educate professionals and the public.
- Create an authority (or czar) for road safety with the vision and clout analogous to that of Bill Haddon in the 1960s, but informed by a new, broader paradigm.
- Track and publicize the annual total economic and social costs of road crashes to the nation, to the states and provinces, and to individuals.
- Create and publicize full-cost scorecards for jurisdictions to indicate how they are balancing costs and losses and where they are externalizing costs.
- Do cross-sectional jurisdiction survey and modeling studies to find out to what extent program differences contribute to different crash records for different states and provinces and what can be learned from these differences, and then act on the findings.
- Do the longitudinal analysis of the fatality reductions over the last forty years to identify the contributions of vehicle, highway, and driver interventions.
- Do the cross-sectional analysis to see how much the age of their private vehicle fleets contributes to differences in fatality rates among states and provinces.
- Establish national tracking and enhance research on current traffic enforcement levels and trends.
- Do the historical data modeling and cross-jurisdiction studies to find the factors that produced the orderly driving cultures of North America.
- Analyze the budgetary savings and crash costs of reduced traffic enforcement and diversion of offenders from judicial and administrative actions and balance these against the crash costs produced.
- Support development of vigorous interdisciplinary research and graduate training on road safety management, recruiting participation particularly from previously quiet fields, such as political and administrative sciences.
- Identify the strongest and weakest safety programs in North America, then produce mentoring "buddy groups" consisting of one of the weak jurisdictions, a strong jurisdiction, and one of the low or middle income nations, all with some geographic or economic commonalities.
- Search out promising pilot programs from the existing safety research literature and follow up on the more solid-seeming findings.

* The word "hopefully" is used here deliberately as an example of how it often is used in program plans. Here, as always, it should be seen as a subtle indicator that the writers may be out of their depth.

This list is clearly pretty limited and demonstrates the halting fluency that we have (or at least that the author has) in formulating well-supported strategies for changing our own cultural paradigm. It is always hard to think about how we think, and especially how we might change it. The nature of culture is to be pervasive and mostly invisible to us, like the air we breathe, unless we take steps to make it visible. In road safety, we have not had a great deal of practice at this in the last forty or so years. With practice, we can become better at it and produce the shift necessary to bring drivers to the safety party as full participants—hopefully.

References

Albert, D. M. 1997. *Order out of chaos: Automobile safety, technology and society 1925 to 1965*. Unpublished Ph.D., University of Michigan–Ann Arbor.

Bjornskau, T., and R. Elvik. 1992. Can road traffic law enforcement permanently reduce the number of accidents? *Accident Analysis and Prevention* 24 (5): 507–20.

Bonnie, R. J. 1985. The efficacy of law as a paternalistic instrument. *Nebraska Symposium on Motivation* 33:131–211.

Brown, I. D. 1986. Prospects for improving road safety. *Ergonomics* 29 (12): 1495–1505.

Carroll, B., and R. Solomon. 2000. Understanding drinking and driving reforms: A profile on Ontario statistics. *Injury Prevention* 6:96–101.

Cirillo, J. A., F. M. Council, M. S. Griffith, E. Hauer, and J. F. Paniati. 2000. *Making safety management knowledge based*. Washington, DC: Transportation Research Board, Committee on Safety Data, Analysis, and Evaluation.

Cummins, J. D., and M. A. Weiss. 1999. The incentive effects of no fault automobile insurance. In G. Dionne and C. Laberge-Nadeau, eds. *Automobile insurance: Road safety, new drivers, risks, insurance fraud and regulation*. 283–308. Boston: Kluwer Academic Publishers.

Evans, L. 2004. *Traffic Safety*. Science Serving Society. Bloomfield Hills, Michigan.

Farmer, C. M. and A. D. Lund. 2006 *Trends Over Time in the Risk of Driver Death: What if Vehicle Design Had Not Improved?* Insurance Institute for Highway Safety. Arlington, Va. www.iihs.org.

FHWA. 2005 *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users; A Summary of Highway Provisions*. Federal Highway Administration, Office of Legislation and Intergovernmental Affairs. Washington, D.C.

Forsyth, I., and E. J. D. Ogden. 1993. Marketing traffic safety as a consumer product in Victoria, Australia. In Utzelmann, H. D. and G. Berghaus and G. Kroj, eds. *Alcohol, drugs and traffic safety–T'92: Proceedings of the 12th International Conference*. Cologne, Germany: Verlag TUV Rheinland, pp. 1437–42.

Friedland, M. L., M. Trebilcock, and K. Roach. 1990. Regulating traffic safety. In M. L. Friedland, ed. *Securing compliance: Seven case studies*. 165-324. Toronto: University of Toronto Press.

Geller, E. S. 1998. *The psychology of safety. How to improve behaviors and attitudes on the job*. Boca Raton: CRC Press.

Gerrard, M., F. X. Gibbons, and M. Resi-Bergan. 1999. The effect of risk communications on risk perceptions: The significance of individual differences. *Journal of the National Cancer Institute Monographs* 25:94–122.

Green, L. W. 1999. Health education's contribution to public health in the twentieth century: A glimpse through health promotion's rear-view mirror. *Annual Review of Public Health* 20:67–88.

Green, L. W., and M. W. Kreuter. 1991. *Health promotion planning: An educational and environmental approach*. Mountain View, CA: Mayfield Publishing.

Haight, F. A. 1985. Road safety: A perspective and a new strategy. *Journal of Safety Research* 16 (3): 91–98.

IIHS. 2006. Electronic stability control is reducing multiple-vehicle crashes as well as crashes involving one vehicle. *Status Report* 41:5.

Jiang, C., G. Underwood, and C. I. Howarth. 1992. Towards a theoretical model for behavioural adaptations to changes in the road transport system. *Transport Reviews* 12 (3): 253–64.

Jones, B., D. Sleet, A. Dellinger, D. Wallace, K. Quinlan, and C. Branche. 1999. Motor-vehicle safety: A 20th century public health achievement. *Morbidity and Mortality Weekly Report* 48 (18): 369–74.

Kim, Dong-Hwan, and Doa Hoon Kim. 1997. A system dynamics model for a mixed-strategy game between police and driver. *System Dynamics Review* 13 (1): 33–52.

Koltzow, K. 1993. Road safety rhetoric versus road safety politics. *Accident Analysis and Prevention* 25 (6): 647–57.

Lacey, R. 1986. *Ford: The Men and the Machine*. Toronto, Ontario: McClelland and Stewart.

Leiss, W. 1990. Traffic safety and the media environment. In J. P. Rothe, ed. *Challenging the old order: Toward new directions in traffic safety theory.* 149–64. New Brunswick, NJ: Transaction Publishers.

Lonero, L. P., J. A. Pierce. 1981. History and evaluation of seat belt legislation in Ontario. In R. N. Green and E. Petrucelli, eds. *The Human Collision: International Symposium on Occupant Restraint*. (June 1–3, 1981) Toronto, Ontario. Morton Grove, Illinois: American Association for Automotive Medicine, 119–31.

Lonero, L. P., K. M. Clinton, G. J. S. Wilde, K. Roach, A. J. McKnight, H. MacLean, S. J. Guastello, and R. Lamble. 1994. *The roles of legislation, education, and reinforcement in changing road user behaviour.* Toronto, Ontario: Ontario Ministry of Transportation.

Lonero, L., K. Clinton, J. Brock, G. Wilde, I. Laurie, I., and D. Black. 1995. *Novice driver education model curriculum outline*. Washington, DC: AAA Foundation for Traffic Safety.

Martinez, R. 2000. The status of traffic safety in the United States. In H. von Holst, A. Nygren, A. E. and A. E. Andersson, eds. *Transportation, traffic safety and health— Human behavior.* Fourth International Conference, Tokyo, Japan, 1998. Berlin: Springer, 7–13.

Mashaw, J. L., and D. L. Harfst. 1990. *The struggle for auto safety.* Cambridge, Massachusetts: Harvard University Press.

Mattaini, M. A., and B. A. Thyer, eds. 1996. *Finding solutions to social problems. Behavioral strategies for change*. Washington, DC: American Psychological Association.

McCartt, A. T., and L. L. Geary. 2003. *Longer Term Effects of New York State's Law on Handheld Cell Phone Use*. Insurance Institute for Highway Safety, Arlington, Va. www.iihs.org.

Mikkonen, V. 1997. Paradigms of practice beyond traffic safety theories and models. In T. Rothengatter and E. Carbonell Vaya, eds. *Traffic and transport psychology.* Amsterdam: Pergamon, 77–84.

Nader, R. 1965. *Unsafe at any speed: The designed-in dangers of the American automobile*. New York: Grossman.

OECD Scientific Expert Group. 1990. *Behavioural adaptations to changes in the road transport system*. Paris: Organisation for Economic Co-operation and Development, Road Transport Research.

O'Neill, B. 2005. Improving U.S. highway safety: Have we taken the right road? *TR News* 329:24–7. Also see Chairman's Luncheon (Address), TRB 84th Annual Meeting, Washington, D.C. January 12, 2005. Insurance Institute for Highway Safety, Arlington, Va. www.iihs.org.

Peck, R. C., and E. J. Healy. 1995. *California's Negligent Operator Treatment Program Evaluation System, 1976–1995*. Report # 155. Sacramento, CA: California Department of Motor Vehicles.

Preusser, D. F., and R. D. Blomberg. 1984. Reducing child pedestrian accidents through public education. *Journal of Safety Research* 15 (2): 47–56.

Reese, J. H. 1965. *The legal nature of a driver's license*. Master of Laws Thesis, George Washington University. Published by the Automotive Safety Foundation, Washington, DC. (LC Catalog 65-29205).

Roach, K. 1999. *Due process and victims' rights: The new law and politics of criminal justice*. Toronto: University of Toronto Press.

Robertson, L. S. 1997. Health policy, health behaviour, and injury control. In D. S. Gochman, ed. *Handbook of health behaviour research IV: Relevance for professionals and issues for the future*. New York: Plenum Press.

Ross, H. L. 1991. *Punishment as a factor in preventing alcohol-related accidents*. Paper presented at the International Symposium: Alcohol-related accidents and injuries. Yverdon-les-Bains, Switzerland. December 2–5.

Rothman, A. J., and M. T. Kiviniemi. 1999. Treating people with information: An analysis and review of approaches to communicating health risk information. *Journal of the National Cancer Institute Monographs* 25:44–51.

Rumar, K. 1988. Collective risk but individual safety. *Ergonomics* 31 (4): 507–18.

Traynor, T. L. 1993. The Peltzman Hypothesis revisited: An isolated evaluation of offsetting driver behavior. *Journal of Risk and Uncertainty* 7 (7): 237–47.

Tsebelis, G. 1989. Abuse of probability in political analysis: The Robinson Crusoe fallacy. *American Political Science Review* 83 (1): 77–79.

Tyler, T. R., and F. L. Cook. 1984. The mass media and judgments of risk: Distinguishing impact on personal and societal level judgments. *Journal of Personality and Social Psychology* 47 (4): 693–708.

Wilde, G. J. S. 1993. Effects of mass media communications on health and safety habits: An overview of issues and evidence. *Addiction* 88:983–96.

———. 1994. *Target risk: Dealing with the danger of death, disease and damage in everyday decisions*. Toronto, ON: PDE Publications.

———. 2001. *Target risk 2. A new psychology of safety and health*. Toronto, ON: PDE Publications.

Wilde, G. J. S., and M. J. Ackersviller. 1981. *Accident journalism and traffic safety education: A three-phase investigation of accident reporting in the Canadian daily press.* Ottawa: Transport Canada.

Wiliszowski, C. H., J. H. Lacey, E. Cyr, and R. K. Jones. 2001. *A Trend Analysis of Traffic Law Enforcement In the United States*. National Highway Traffic Safety Administration, Office of Research and Traffic Records, DOT HS 809 269, NTIS or www.nhtsa.dot.gov.

Yanovitzky, I., and C. Bennett. 1999. *Media attention, institutional response, and health behavior change. The case of drunk driving, 1978–1996.* Communication Research 26 (4): 429–53.

Biographical statement

Larry Lonero has over 30 years experience in many aspects of road safety, including human factors research, program development and evaluation, field operations, strategic management, and policy. He holds degrees in psychology. In 1990, he cofounded Northport Associates, a consulting firm that has conducted studies in driver education, novice driver decision making, driver improvement, driver and health-related behavior change, and road safety policy and strategic overviews for government and private sector clients. The extensive list of projects includes the influential project to "reinvent" driver education sponsored by the AAA Foundation for Traffic Safety. Major projects followed to evaluate and develop new driver education curriculum for Manitoba Public Insurance, and projects to develop guidelines for evaluation of driver education and then implement the guidelines, again sponsored by the AAA Foundation.

Before entering consulting he worked in a large integrated transportation department—coordinating research, program development, policy, and corporate strategy. He has championed research-based program development and empirical program evaluation. He coordinated the preparatory research, policy support, and public education that enabled introduction of North America's first seat belt law. He has long promoted the use of public-health approaches in road safety, and he served on the Working Group developing the Motor Vehicle Injury Prevention Research Agenda for CDC/NCIPC and as an advisor to the WHO/World Bank 2004 initiative. He is active in driver factors analysis for civil litigation in road crashes. He maintains interest and contacts in automotive industries and currently serves as a judge in the PACE Awards for Innovation in Automotive Technology, sponsored by Automotive News, Microsoft, SAP, and the Transportation Research Center of Ohio. He is a member of the TRB Committee on Operator Education and Regulation, the Canadian Association of Road Safety Professionals, the American Driver and Traffic Safety Association, and the American Evaluation Association.

Effecting a traffic safety culture:
Lessons from cultural change initiatives

Connie L. McNeely and Jonathan L. Gifford

School of Public Policy, George Mason University

Overview

While discussions of traffic problems and the search for solutions are typically focused on traffic behavior itself, the recognition that traffic safety is a fundamentally cultural issue suggests the utility of deriving lessons from other culturally defined problems in order to inform and provide an analytical reference point for traffic safety cultural change approaches. Accordingly, instead of examining traffic behavior *per se*, the focus here is on major issues from other policy arenas that have been prominent on the public agenda and in which fundamental cultural change has been the preeminent policy goal: solid waste recycling, drug abuse, and tobacco use.

By examining their basic goals and parameters, detailing their practical applications and approaches, and assessing their relative effectiveness, related anti-waste, anti-drug, and anti-smoking intervention strategies can provide practical insights to inform future efforts for improving traffic safety culture.

Review of related approaches reveals that, while specific details may differ, general strategies have been largely the same across areas. An examination of successful and unsuccessful initiatives reveals most emphatically that such problems must be addressed at, not only the individual level, but the cultural level involving the attitudes and values affecting behavior. Practically speaking, most change initiatives will only be effective when supplemented with other efforts at community capacity building and deployed in combination with others. Moreover, a crucial point derived from consideration of various cultural initiatives is that, even if change initially occurs, it cannot be maintained in the face of inconsistent norms in the larger society without subsequent reinforcement.

Applying lessons gleaned from anti-waste, anti-drug, and anti-smoking interventions to problems of traffic safety, recommendations are offered focusing on 1) education programs addressing home, school, and community influences, 2) multilevel strategies addressing social environments, and 3) interventions addressing social and economic conditions. Moreover, these recommendations are linked to a variety of intervention approaches using multiple tactics at multiple levels of influence, involving a variety of societal sectors, focusing on general cultural determinants, and employing both short- and long-term perspectives. In short, coordinated, sustained, multilevel approaches offer the greatest promise for realizing a traffic safety culture.

Introduction

Traffic safety is an outgrowth of broader cultural conventions, norms, attitudes, and behaviors. Indeed, recognizing that traffic safety culture is part and parcel of the broader societal culture can

help to explain some of the wide variation in driving behavior from place to place—witness the differences in driving in Los Angeles, Washington, D.C., and Paris, France. Traffic behavior is marked by cultural dynamics and, accordingly, concern over behaviors detrimental to traffic safety, such as aggressive driving, driving while intoxicated, or running red lights, has led to campaigns that seek to change the norms, attitudes, and actions that affect traffic safety—in other words, that seek to change the traffic culture into a traffic *safety* culture.[1]

However, what kinds of approaches are effective? How can traffic culture be changed, in practical terms, to increase safe behavior? What kinds of initiatives can lead to positive outcomes?

Thinking about cultural change often implies thinking about changes in "solutions that use social resources to repair conditions and/or to encourage or coerce individual change," that is, about changes in related public policies (Schneider and Ingram 1990; Loseke 2003, 101). However, while changes in laws and policies might coerce changes in given individual behaviors, they do not necessarily affect the ways that people think overall. Indeed, policies often fail when they are not supported by real cultural changes (Polletta 1997; Loseke 2003).

Considering this relationship between culture and policy effectiveness, we suggest that adopting a broader perspective on cultural effects and approaches might provide a fruitful avenue for addressing traffic safety problems as a fundamental societal concern. Cultural change initiatives that are directed at social problems seek to encourage the overall condemnation of a behavior that has been defined as socially negative. Whether concerning, for example, drunk driving, smoking, or child abuse, cultural change means producing attitudinal shifts that are subsequently linked to behavioral modifications. Hence, smoking cigarettes went from being generally acceptable (even romantic) to unacceptable (and distinctly unromantic); "safe sex" is more commonly practiced than previously; "child spanking," rather than discussed as a simple parental right, has drawn increasing public criticism; and "drunk driving" has gone from being laughed about to being considered distinctly not funny (Loseke 2003, 113–14).

Moreover, research shows that policymakers will not seriously address a problem unless it is attached to some image of courses of action to eliminate the problem or alleviate related negative effects (Loseke 2003). This concern about what should be done involves determining and legitimating certain solutions along with constructing indicators of success and expected outcomes.

Here, we can invoke an image of culture as a "tool kit" of symbols, practices, and views that people use in varying configurations to address different kinds of problems (Swidler 1986). Culture provides a tool kit or repertoire of resources from which diverse strategies of action can be constructed and, by selectively considering different "styles and habits of action" from different arenas, we might be able to bring them to bear on the problem of traffic safety culture.

The impact of the "culture of driving behavior" on safety has been widely examined in the traffic literature (see, e.g., Zaidel 1992; Aberg, Larsen, et al. 1997; Aberg 1998; Musselwhite 2006; Ozkan, Lajunen, et al. 2006). Some studies have also examined the effectiveness of various programs and policies aimed at promoting safer driving, such as stricter law enforcement and higher police presence (Castella and Perez 2004; Guria and Leung 2004; Blincoe, Jones, et al. 2006) and educational programs (McKnight and McPherson 1986; Guria 1998; Owsley, Stalvey, et al. 2003). Other investigations have attributed some 200,000 traffic deaths in the United States (U.S.) in the last few decades to the U.S. tendency to focus on more technologically determined

1 E.g., the "Smooth Operator" campaign in the Washington, D.C. metro region.

outcomes (e.g., crash survivability due to automobile design improvements) in policy making rather than also attending to behaviorally oriented policies to improve traffic safety (Evans 2006). Yet, traffic culture is part of a wider cultural system, which behooves us to recognize affective elements of cultural experience and practice that locate behavior not only in subjective individual values and actions, but also in the context in which meaning is attached to that behavior.

While most discussions of traffic problems and violations and the related search for solutions are internally focused, we suggest that casting a wider net might prove useful for determining strategies that can affect traffic safety culture. That is, by examining approaches aimed at cultural change in other social problem areas, we might learn ways by which to effectively address traffic safety. Thus far, the efficacy of most traffic safety campaigns have not been sufficient to create a significant and lasting change, to the extent that U.S. traffic safety policy has been called a "dramatic failure" (Evans 2006). However, as a fundamentally cultural issue, traffic safety arguably can be informed by insights from other cultural arenas. By thinking conceptually in terms of broader cultural dynamics, rather than simply addressing characteristics of traffic problems per se, we can consider the modes of cultural reproduction and how they might be affected in order to improve outcomes for traffic safety.

To that end, we propose a model that assumes the dynamic interaction of cultural factors where behavior is shaped by a variety of features—not only, for example, age, gender, and socioeconomic differences, but also more explicitly attitudes, beliefs, values, and norms as cultural foci. Such factors can directly and indirectly account for differences in traffic behavior and, thus, in the overall traffic culture. However, instead of organizing our discussion around the obvious and direct issues of traffic behavior per se, we instead look to other issues in which fundamental cultural change has been the preeminent policy goal: recycling, drugs, and smoking. Selected in part due to their prominence on policy agendas in the U.S. and elsewhere, these issues have been identified as critical problem areas to which large amounts of funding and attention to program development have been dedicated. By investigating strategies that have been used to produce cultural change in these arenas, we hope to derive lessons that can inform general approaches to traffic safety given its identity as a fundamental cultural issue.

Accordingly, after briefly describing the problem areas and the basic issues surrounding them as such, we delineate and assess related cultural change initiatives in terms of their implementation approaches and outcomes. We then consider the possible cross-sector applicability of these approaches, considering their implications for affecting traffic safety culture. We conclude by summarizing the specific lessons learned from analysis of the cultural change approaches relative to traffic safety culture. We also present recommendations for strategies to undertake in developing initiatives aimed at realizing a traffic safety culture.

Cultural change issue areas

Recycling, drug abuse, and smoking have received a great deal of policy attention and funding in the U.S., with the aim of changing behavior not merely for selected individuals, but for society as

a whole. While certainly other policy areas can also be identified for this purpose, recycling, drugs, and smoking have, over time, remained high on the public policy agenda.

Recycling

All fifty U.S. states have laws requiring reductions in the amount of solid waste sent to landfills. These laws have led cities and counties across the country to implement a variety of related programs, of which household or residential recycling is one of the best known. Recycling refers to the collection of used items for use in the manufacturing of new items (Schultz 2002), and household recycling programs also require residents to clean, sort, store, and deliver recyclables to curbsides for pickup or designated drop-off locations.

Although earlier efforts existed (Pellow 2002), organized recycling programs gained greater public awareness beginning in the late 1960s. Recycling drop-off centers were established in a few cities, such as Berkeley, California, Ann Arbor, Michigan, and Chicago, Illinois (Melosi 2005); curbside pickup newspaper recycling was first organized in Madison, Wisconsin in 1968; and in 1971 Oregon became the first state to offer deposit refunds on drink containers. Begun as social and environmental awareness actions, the recycling "movement" was often framed as a "counter-culture" and "anti-corporate" development. Recycling was engaged more as a matter of environmental consciousness and civic morality.

However, little by little, recycling entered the mainstream. Questions of business viability were posed and related industries began to support recycling programs in the face of potential profits. In particular, the aluminum industry started aluminum can buy-backs the 1970s.[2] Additionally, the mid-1980s saw tightening environmental restrictions and widespread perceptions that landfill space was growing scarce. Visions of a looming landfill "crisis" led to public initiatives for solid waste management to reduce the quantities of waste being landfilled. The most pervasive of these intervention initiatives was residential curbside recycling. Also in response to dramatically increasing waste disposal costs, more and more local and state governments launched recycling programs, to the extent that, by 1989, most large metropolitan areas had established curbside recycling, with residential participation rates ranging from 49 to 92 percent (Melosi 2005).

Drugs

A topic "bristling with emotional and political thorns," illegal drug consumption and the design of programs to control drug use have posed some of the most difficult and divisive topics on the U.S. policy agenda (Gerstein and Green 1993, 2; Manski, Pepper, et al. 2001). Drug abuse has variously referred to, among other things, fully illicit drugs (e.g., marijuana, heroin, and crack cocaine) and also certain prescription-only drugs (e.g., barbiturates and amphetamines), and, for

2 While actively lobbying against environmental bills that would require recycling commitment.

adolescents, "adults-only" drugs (e.g., alcohol).[3] Psychoactive drugs that are illegal for minors to purchase in the United States have been of particular concern as an area for preventive intervention.

Early depictions of drug use as "sinful" gained momentum during the Progressive Era, particularly through the efforts of temperance advocates for the creation of a "moral society." Intensive lobbying resulted in regulation and restricted sales, but also in the creation of a large black market, which further fostered a perception of drug addiction as immoral and as a crime, a perception that shaped subsequent drug policy. The increased criminalization of drugs and drug users over time has been led by politicians running on "getting tough on drugs" platforms. Public officials at all levels—local, state, federal, and international—have been charged with waging the "war on drugs" (Manski, Pepper et al. 2001)—a highly protracted war. Although, there have been efforts and limited success backed by scientific evidence to frame drug use (abuse) in therapeutic terms, the prevailing approach has been one of punitive measures.

Smoking

Having traditionally been a pursuit of the upper strata of society, tobacco use started filtering down to the other social classes, principally in the form of cigarettes, during the 19th century (Kluger 1996). However, attacked on moralistic grounds by temperance advocates (as they did the imbibing of alcohol), tobacco use was banned in 14 states in the early 20th century. Yet, these restrictions were short lived and tobacco smoking soon regained not only acceptability, but also was established as desirable behavior again by the 1950s (Markle and Troyer 1979). Tobacco is a highly profitable industry and its use has been glamorized and linked to positive social features. Advertisements have depicted users as being urbane, mature, sexy, and sophisticated across various social strata at various points in time. At one time, smoking was considered to be manly and even patriotic, and later was marketed to women as a symbol of independence and accomplishment.

However, a number of studies linking smoking to lung cancer and other illnesses began appearing in the 1950s (Parascandola 2001). Although at first ignored, these studies gained credence with the release of the 1964 Surgeon General's report (U.S. Department of Health, Education, and Welfare 1964), which was the first in a long series explicitly stating the dangers of smoking based on scientific evidence. Furthermore, not only have health dangers been noted for smokers, but exposure to secondhand smoke has been shown to have serious and deadly effects on nonsmokers as well (U.S. Department of Health and Human Services 2006). Indeed, since the original Surgeon General's report, research has shown repeatedly that "tobacco smoke is the cause of the most deadly epidemic of modern times," leading to a wide variety of cancers,[4] chronic obstructive pulmonary disease, myocardial infarction, and stroke (Stratton, Shetty, et al. 2001, 1).

3 For adolescents, "adults only drugs" also often refers to tobacco products in the literature.
4 E.g., lung, oral cavity, esophagus, larynx, pancreas, bladder, and kidney.

Yet, although less than in the 1950s, more than a quarter of the adult population in the U.S. are still smokers.

Intervention approaches

Recycling, drugs, and smoking are all areas in which substantial interventions have been dedicated to changing culturally defined behaviors and values. Looking more closely at those interventions and delineating their particular features, as emphasized below, might prove instructive for determining and assessing approaches to effecting cultural change in the area of traffic safety.

Recycling

A number of intervention strategies have been employed to encourage people to recycle, *aimed at both personal and situational determinants*. Personal determinants are individual characteristics such as knowledge, attitudes, beliefs, and ascribed personal responsibility; situational determinants are context characteristics related to behavior, such as types of materials that are collected and collection locations (Schultz 2002). In general, participation in residential solid waste recycling programs have tended to be higher among more affluent and older people, and lower among less affluent and younger households, probably due in part to the availability of both storage space and time (Martin, Williams, et al. 2006). Moreover, even when attitudinal research indicates high levels of willingness to participate in recycling programs, recycling services have often been found to be too unreliable and inconvenient to allow comprehensive participation (Oskamp, Harrington, et al. 1991; Martin, Williams, et al. 2006). Accordingly, policy recommendations have included suggestions for the provision of bespoke recycling *services to suit a variety of conditions* in different residential settings and for the provision of *regular feedback* to households regarding recycling services and performance (Martin, Williams, et al. 2006).

Although further research is needed to identify underlying psychological and social attitudes that influence recycling participation, we know that recycling behavior is open to a range of influences, including environmental values, situational characteristics, and psychological variables (Vingilis, Stoduto, et al. 1994). Accordingly, strategies for promoting a "culture of environmental responsibility," which includes household waste recycling, must take such factors into account. Recycling participation has been the highest in municipalities with *mandatory programs*. The *capacity to impose sanctions* in the case of mandatory programs, or to issue verbal warnings or reminders in case of voluntary programs, has also had positive effects. Making recycling easier, through, for example, curbside pickup and provision of free recycling containers, increases participation as well. In the case of voluntary programs, *citizen involvement in program design* itself enhances participation (Folz 1991).

Recycling is typically framed as virtuous behavior that benefits the environment and society. To improve household recycling behaviors, school courses have emphasized a *moral obligation* to nature and society as a cultural norm. Also, initial recycling experience quickly sets attitudes that are stably maintained into the longer term (Tucker and Speirs 2003). Thus, teaching children "responsible environmental behavior" early on is crucial to increasing participation rates. As

such, school programs in which children are taught not just the "virtues" of recycling, but also that frame recycling behavior as an appealing personal characteristic, and in which they are encouraged to take part in related activities in the classroom, are recognized as a significant *socialization strategy.* However, *regular reinforcement* is also needed to counteract specific subsequent adverse experiences that might be encountered, from which attitudes might weaken and drop-out might occur (Tucker and Speirs 2003).

There is a strong positive relationship between *normative beliefs* (i.e., perceptions of social pressure) and recycling behavior. Practical approaches for making recycling normative include, for example, *engaging community influences* (Schultz 2002). One suggestion is neighborhood leader programs in which leaders take responsibility for recycling within their neighborhoods, recycling diligently, and encouraging neighbors to recycle. These programs have been shown to have a direct effect on normative beliefs and have been successful at producing sustained increases in recycling behavior. Another approach for making recycling normative is through the *dissemination of information* on recycling and the recycling program to residents (e.g., through newsletters, newspaper articles, public service announcements, or billing inserts) to support beliefs about, for example, recycling levels and efforts of other residents.

Furthermore, the *education* of citizens on the importance of recycling also positively affects the participation rate, and *procedural information* about the where, when, and how of recycling and typically disseminated through brochures, advertisements in local newspapers, presentations in local meetings, etc., is a practical requirement for program fulfillment. The most common interventions for promoting recycling employ education approaches, based on the assumption that low recycling rates result from a lack of information and that increasing information will translate into a behavior change (Schultz 2002). Arguably, procedural information campaigns often will be ineffective if that they do not attend to the *motives for participation*, concerning, in particular some motivational factors, such as: 1) the benefits of recycling, 2) personal inconvenience, 3) external pressure, and 4) financial motives (Oskamp—in Schultz 2002, 72).

Most research on recycling has focused on procedural information and has, in fact, revealed that the more procedurally knowledgeable a person is, the more likely that person is to recycle. However, this is not necessarily a causal relationship and further research has indicated that *information is not sufficient to produce a change* in recycling behavior (Schultz 2002). Even when changes have been observed following information interventions, they typically have been short-lived.

Drugs

Anti-drug interventions have been found to be, across the board, "effective, not effective, and countereffective" (Gerstein and Green 1993, 3)—a mixed bag in need of more focused evaluation. *Enforcement of laws* that prohibit the possession and use, in addition to the manufacture and sale, of illegal drugs has been the primary anti-drug strategy in the U.S.[5] However, intervention also has encompassed an array of noncoercive activities intended to prevent, reduce, or delay illegal drug use, with mixed results (Manski, Pepper, et al. 2001, 8).

5 Comprehensive research has been sorely lacking on the actual effectiveness evaluation of law enforcement as an anti-drug use and prevention strategy. For further discussion and references on this point, see (Manski et al. 2001).

For example, *education programs* were developed to provide information as a kind of "social marketing" tactic with the goal of motivating people to act or behave in a particular way (Schultz 2002). As education interventions, anti-drug *media campaigns* have operated largely to provide information about associated risks in the hope that they would engender behavioral change. Although they have sometimes attempted to directly affect people,[6] for the most part anti-drug campaigns have simply provided information (Wallack 2000, 345). Focused principally on education, these and similar programs rest on approaches in which "the problem is operationally defined as people just not knowing any better. The goal, then, is to warn and inform people so they can change.... The message is always about personal change rather than social change" (cf. Wallack 2000, 346). Developed on the same basis, most school anti-drug programs are constructed around intervention strategies that typically do not "deal directly with the training of behavior between peers, but rather focus only on increasing knowledge about health effects, improving interpersonal skills, or improving feelings of self-esteem" (Gerstein and Green 1993, 4). Note that these programs have been deemed largely ineffective.

Even programs such as the much touted Project D.A.R.E. (Drug Abuse Resistance Education) have been found ineffective. Focused on peer-pressure resistance and self-esteem building, the D.A.R.E. intervention produced a few initial improvements in student attitudes toward drug use. However, changes did not persist over time; there were no effects on actual drug use initially or during follow-up periods (Lynam, Milich, et al. 1999; West and O'Neal 2004). Another example is the highly visible, billion dollar National Youth Anti-Drug Media Campaign. First authorized in 1998 and reauthorized in 2003 by the U.S. Congress, it also has produced little evidence of effectiveness in reducing drug use among teenagers (Eddy 2004). Frankly, even when school-based drug education programs have shown some effect, results have tended to be neither strong nor long lasting when taken alone.

In general, while teaching children to refrain from drug use is a widely accepted strategy, many popular approaches, such as "zero-tolerance" programs, have not been evaluated. Indeed, "on balance, no drug abuse prevention activities have been adequately evaluated and found to be reliably effective, in all cases, with all groups" (Gerstein and Green 1993, 3). Having said that, although several caveats apply, there is some evidence of effectiveness in school setting interventions that have focused on counteracting or resisting explicit peer pressure toward use," lodged within a more *general curriculum* emphasizing self-efficacy, interpersonal social skills, and specific knowledge of health effects, followed up with *booster sessions* in a subsequent school year, and concomitant with continuing public health *efforts on a community-wide basis*" (cf. Gerstein and Green 1993, 3).[7] Yet, most anti-drug programs are not well-contextualized. They treat drug abuse as if it occurs in a vacuum and, as discussed above, related initiatives primarily have been aimed only at individual personal behaviors, not at social factors.

Smoking

In response to the 1964 Surgeon General's report on the damaging effects of cigarette smoking, U.S. federal and state governments began introducing *legislation* aimed at curbing the level of

6 E.g., the recent anti-drug campaign that tries to encourage parents to talk to their children about drugs.

7 Note that in regard to tobacco, which is often discussed as an "adults only" drug, such approaches have shown some effectiveness "in delaying the onset of cigarette smoking for a sizeable fraction of students who would otherwise have begun smoking early in their adolescence" (Gerstein and Green 1993, 3).

smoking and sponsoring a variety of related programs. In addition, a number of *nonprofit organizations* became increasingly active in this area, pursuing various approaches to effect smoking cessation. Significantly, in 1981, the American Cancer Society, American Lung Association, and American Heart Association combined forces, creating the Coalition on Smoking or Health in order to lobby Congress for anti-smoking regulation in keep with three priority issues: 1) supporting FTC proposals for larger warning labels, 2) increasing the federal excise tax on cigarettes, and 3) stopping federal tobacco price support programs. The Coalition has stood as the strongest advocate challenging the tobacco industry and supporting anti-smoking initiatives.

The continuing toll of smoking has prompted the development of a wide range of efforts aimed at harm reduction for those who cannot or will not stop using tobacco and associated risk to others, and at curbing tobacco use altogether. Also, since the vast majority of smokers begin during adolescence (Stratton, Shetty, et al. 2001), major efforts have targeted young people in particular. Anti-smoking programs tend to fall into one of two main strategies: 1) limiting consumer choices and 2) helping them make better choices (i.e., to quit or not begin smoking). Choice limitation has relied on *legislated actions,* such as higher taxes on tobacco products, making it illegal to sell such products to minors, designating "clean air" areas and limiting smoking in public areas. Helping consumers make better choices refers primarily to *informational strategies,* such as requiring health warnings on cigarette packs, media campaigns, and school curriculum initiatives.

The findings of efficacy studies on anti-smoking initiatives are uneven. Little clear evidence exists on the deterrence effectiveness of tax increases or on the effectiveness of limiting minor access to tobacco products. However, the effectiveness of minor-access limitation is arguably a question of enforcement, an area in which most states fail (American Lung Association 2005). Research suggests some positive effects of *media campaigns,* both informational and aimed at deglamorizing smoking. However, analysts recommend caution because the studies reflect short-term findings only and also are highly specific and cannot be generalized to anti-smoking campaigns as an encompassing approach (Sly, Hopkins, et al. 2001; Hyland, Wakefield, et al. 2006). In general, there is some indication of media efficacy in preventing the uptake of smoking in young people, but the overall evidence is not strong (Sowden and Arblaster 2005). Also, evaluations of school anti-smoking programs have been highly variable. In fact, one of the largest and most rigorous studies, which assessed the Hutchinson Smoking Prevention Project, an intensive 8-year program on smoking behavior, found no long-term effect. There are few rigorous tests of the efficacy of information provision and, also, little high-quality evidence about the effectiveness of combinations of social influences and social competence interventions, nor of *multimodal programs* that include *community interventions* (Porter and Berry 2001).

The better anti-smoking campaigns, like anti-drug campaigns, have been "characterized by at least three important factors. First, these campaigns are more likely to use mass communication and behavior change theory as a basis for campaign design. This means *using a variety of mass communication channels,* making sure the audience is exposed to the message, and providing a clear and specific action for the individual to take. Second, they are more likely to *use formative research*, such as focus groups, in order to develop messages and inform campaign strategy. Many better-designed interventions also include various *social marketing strategies,* such as market

segmentation, channel analysis, and message pretesting. Third, they are more likely to *link media strategies with community programs,* thus reinforcing the media message and providing local support for desired behavior changes" (Wallack 2000, 346).

In general, although conflicting reports on current adolescent smoking behavior leave the current situation unclear (National Research Council (NRC) 2006), we can say that it appears that the effects of *school-based anti-smoking initiatives* are best sustained when *related changes in the larger community* also take place and when there is *reinforcement over time*. When behaviors promoted by the school-based programs are inconsistent with the larger community norms, maintenance of the positive behaviors is significantly limited (Perry 2000). Research showing associations between anti-smoking attitudes and beliefs, as well as reduced smoking among students with exposure to anti-tobacco advertising, also suggested the importance of *periodic repeated exposure* to related advertisements for the general teen viewing audiences (Preidt 2006). Furthermore, while reports of studies on anti-tobacco *media campaigns and message development* indicated their association with more favorable anti-smoking attitudes and beliefs and reduced prevalence of smoking (Preidt 2006), *economic disincentives* (e.g., increases in cigarette excise taxes and higher pricing of tobacco products) and enforcement of *regulatory directives* (e.g., indoor air quality laws, restrictive regulations on cigarette vending machine use, minimum age for purchase laws, and controls on advertising), when *applied simultaneously with individual-level interventions* (e.g., behavioral and pharmacological approaches) and smoking cessation programs, have proved most effective. That is, while individual level interventions have yielded only marginal success at best, greater progress in reducing the prevalence of smoking has resulted when they were engaged in coordination with population-wide interventions; the most successful anti-smoking campaigns have reflected a combination of approaches (Warner 2000).[8]

Lessons for traffic safety initiatives

Review of intervention approaches that have been employed in anti-waste, anti-drug, and anti-tobacco efforts reveals a variety of features in common, despite targeting different policy areas. These common features suggest the possibility of cross-sector applicability of approaches, or certainly of implications for effecting policy strategies in other fields. While traffic safety obviously encompasses different issues and concerns, the underlying dynamics and the logic of affective cultural change may be more broadly applicable. Accordingly, examination of initiatives in other fields might profitably inform efforts relative to specific traffic safety aims and might help to identify cultural factors and approaches, along with social and behavioral ones, that could be useful in improving traffic safety for everyone.

For example, the social acceptability of smoking has changed significantly in recent decades, and the acceptance of solid-waste recycling as "normal" household behavior has grown substantially. In both cases, explicit cultural programs and initiatives were developed that placed a heavy focus on public education and media campaigns, on school curriculum programs, and on legislative support. Anti-drug initiatives have followed a similar path. While specific details may differ, the general strategies have been very much the same, with varying degrees of success.

8 Also, see papers by Perry, Gostin, Warner, and House and Williams in Smedley and Syme (2000).

As do those of traffic safety, discussions of recycling typically focus on technical issues. However, recycling is a behavior and, "like all human behaviors, recycling is motivated and constrained by the context in which it occurs. The success or failure of a recycling program hinges on participation by community residents" (Schultz 2002, 9). The same point can be made in regard to traffic safety behavior. A narrow individual behavioral focus can deflect attention away from social and structural behavioral determinants by attending exclusively to individual actions, which in effect places the sole burden for change on the individual (Wallack 2000). Obviously, individual behavior must change, but placing the sole emphasis on individual risk-factor modification, which, for example, is the core of most mass media campaigns, has been "spectacularly unsuccessful" (Lomas 1998, 1183). As has traffic safety, solid waste, drug abuse, and tobacco use all have been identified and addressed in terms of social problems, and defining a problem at the community or societal level and then applying primarily individual-level "solutions" is in itself problematic (Wallack 2000).

Behavior-oriented media campaigns, while useful, have typically been limited in creating significant behavior change, in part due to a failure to adequately integrate and contextualize their approach. That is, while individual actions and personal responsibility is obviously important, related behavior is inextricably linked to the larger social, political, and economic environment. Attempting to address publicly defined problems, such as drug abuse or smoking, without attending to the context in which they exist "inevitably produces, at best, limited solutions" (cf. Wallack 2000, 338). The same argument can be made in regard to behaviors directly affecting traffic safety. The need to attend to more generic cultural determinants of behavior is grounded in recognition of the fact that culture has a broad and profound impact on behavior across society. While there may be subcultural and individual differences to consider, balance is also needed in consideration of overarching cultural dynamics and values. Thus, intervention at multiple levels and through multiple sources of influence reflects recognition of crosscutting influences and related determinants of behavior (interpersonal, institutional, community, society, etc.).

Focused most specifically on the provision of information, media campaigns have been a central feature of change initiatives across the board. Moreover, in a very practical sense, information can be a fundamental factor for influencing behavioral change. For example, in the case of recycling, procedural information may not be a motive for recycling, but may still play an important behavioral role since lack of knowledge can be a barrier to action; when people are motivated to act, dissemination of information is likely to produce an increase in recycling behavior (Schultz 2002). However, as has been observed in all three issue areas, information alone is wholly inadequate for engendering lasting change.

Then, what kind of media approaches can increase capacities for positive change? In discussing public health and social change initiatives, Wallack (2000) has suggested civic journalism, media advocacy, and photovoice, along with the Internet, as possibly promising approaches.[9] By providing information and other forms of support, *civic journalism* seeks to increase public participation in problem solving. Reflecting partnerships across newspapers, television, and radio stations, civic journalism typically encompasses three broad activities: 1) extensive information development and data-gathering; 2) extremely extensive and coordinated coverage to increase issue visibility, legitimacy, and urgency; and 3) substantial efforts and development of means to insure and facilitate participation.

9 See (Wallack 2000) for more detailed discussion and examples of these approaches, along with related references.

Media advocacy refers to the strategic use of mass media in combination with community organizing efforts, focusing primarily on news media and secondarily on paid advertising. The principal aim is to "raise the volume of voices" for change and shape the sound so that it resonates with values that are presumed to be the basis for positive behavior. Generally part of a broader strategy, media advocacy focuses on four primary activities: 1) strategy development; 2) agenda setting; 3) debate framing; and 4) policy advancement. Media advocacy has been applied to a variety of public health and social issues, including, child care, alcohol, tobacco, handgun control, and suicide prevention.

Photovoice focuses on grassroots involvement in creating and using photography for social change through participation in the policy process, employing "visible data" to 1) understand issues and concerns through the eyes of most affected groups, 2) promote knowledge and crucial discussion among participants, and 3) mobilize policy makers to create change. The use of pictures in addition to words might arguably increase the effectiveness of efforts for change.

The *Internet* can potentially supplement and increase any media approach; it allows for quick access to a vast array of information and specialized help from virtually anywhere in the world, thus enhancing potential contributions of the other approaches. Again, note that each of these suggestions encompasses broad involvement at various levels of social interaction.

Furthermore, it seems clear that children and adolescents must be a major focus for cultural intervention and change initiatives. Many of the attitudes and values affecting behavior—including traffic behavior—are instituted as part of the socialization process and are, in fact, encouraged by current adult values. There is a disassociation between outcomes and process that often conflicts with the notions of safety—e.g., advertising and movies that imply that traffic "rudeness" and driving aggression is manly or sexy or glamorous. In order to institute a culture of "traffic civility," then an etiquette that is instilled as an expected mode of behavior—not merely a response to laws—must somehow be promoted. Adolescence is a time marked by a focus on peer and social rewards. However, although adolescents are heavily influenced by peer attitudes and conduct, peer group norms themselves can be influenced to improve behaviors associated with positive outcomes as long as those behaviors are supported by consistent and complementary school and community efforts (Smedley and Syme 2000).

Normative beliefs can be a powerful motive for action, especially under certain conditions. In particular, research suggests that "normative social influence works best with behaviors that are publicly observable," as indicated in curbside recycling participation (Schultz 2002, 78). On the one hand, observable behaviors can be monitored by others; on the other hand, observable behaviors can reinforce (or undermine) existing normative beliefs. These considerations are kept practical by providing standards against which an individual can compare his or her behavior and targeting specific behaviors. Moreover, important to the normative process is making the comparison groups those whom individuals know or with whom they can readily identify, rather than making broad comparisons. Other affective factors include perceived similarity with others in the community, status of people engaging in the behavior, prior commitment to act in a particular way, group size, and group cohesion (Schultz 2002).

Consideration of the causal effects of culture and on culture makes clear the necessity of employing a wide range of action strategies if values leading to negative outcomes are to be countermanded. Moreover, a crucial point derived from consideration of cultural initiatives that is particularly relevant to addressing issues of traffic safety is that, even if change initially occurs, it cannot be maintained in the face of inconsistent norms in the larger society without subsequent

bolstering and encouragement. Thus, for example, while anti-smoking campaigns have had some success in the U.S., based on overall decreases in the prevalence of smoking, it appears that smoking rates may again be on the rise, indicating the need for continual reinforcement—at least until the previous behavior is overwhelmingly and consistently devalued and delegitimated and is replaced as the social norm.

Additionally, across issue areas, the pressing need for in-depth comprehensive evaluation to inform policy initiatives is highly apparent. Research on anti-waste, anti-smoking, and anti-drug interventions illuminates the fact that interpretation of the results of population-wide and multilevel initiatives require different criteria from those targeting individuals, and that broad identification and assessment of factors mediating change at various levels of social interaction are required for understanding pathways for cultural change (Smedley and Syme 2000). The collective efficacy of society at various levels represents the potential for mobilizing real and sustained change. Accordingly, a singular myopic focus on individuals and information—or primarily on vehicle safety and technological fixes—is highly insufficient to effect any real and lasting change in traffic safety culture.

Summary and recommendations

Our goal here has been to determine approaches that could effectively ameliorate problems of traffic safety in the U.S. today. Recognizing that traffic safety is a fundamentally cultural issue, we looked to determine and draw upon "lessons learned" from approaches to other culturally defined problems in order to inform and provide an analytical reference point for traffic safety cultural change approaches. Accordingly, we examined selected major cultural change strategies in other arenas, delineating and comparing their basic goals and parameters, detailing their practical applications and approaches, and assessing their relative effectiveness in order to provide insight and inform future efforts to improve traffic safety culture. In addition, we examined how initiatives and their relative efficacy have been assessed and how they have been "interpreted" for public consumption—something that is not always consistent with or backed by actual evidence (Evans 2006). The overall focus on cultural dynamics and lessons learned suggests a fresh perspective on analyzing traffic safety culture and developing solutions to related problems.

Although we have organized our discussion around interventions aimed at addressing negative behaviors associated with specifically identified cultural problems, the principal aim has been to identify social and behavioral approaches that can influence the related cultures and the broader context in which those problems exist. Ideas and practices from other venues might offer prospects for adaptive change to occur in traffic safety culture. The lessons learned from consideration of recycling, drug, and smoking initiatives suggests the utility of further identifying promising areas and approaches, along with specific programmatic efforts, that could inform and facilitate the effective construction of a traffic safety culture. We hope that this approach will stimulate new thinking about approaches to encourage traffic safety and to obviate damaging cultural characteristics in this area.

In particular, we posit culture's causal significance not in defining ends of actions, but in providing the cultural components or tools that can be used to construct strategies for change. This

perspective makes possible new approaches for affecting behavior and modeling forms of authority and cooperation. It is, however, the concrete situations in which these cultural models are enacted that determine which take root and thrive, and which wither and die (cf. Swidler 1986). As stressed across cultural change approaches, *the principal point to keep in mind is that traffic safety culture does not happen in a vacuum and that the broader cultural context must be a critical consideration in developing effective policies and initiative for change.* Emphasis here has been on the essential need to focus attention not only on individual and personal traffic behaviors, but also on those social and cultural forces in the environment that shape and support those behaviors. Practically speaking, most change initiatives will only be effective when supplemented with other efforts at community capacity building and deployed in combination with others for a synergistic effect. Thus, we argue, for example, that simple information dissemination alone is not enough. Of course, mass media campaigns play a significant role in increasing awareness, providing knowledge, and shifting attitudes. However, they must be part of a more comprehensive strategy for contextualizing the values and related risks within the broader issues of societal concern for lasting cultural change (Wallack 2000, 357).

A review of successful and unsuccessful initiatives reveals most emphatically that such problems must be addressed at, not only the individual level, but the cultural level involving shifting attitudes and values. While policy messages may speak to individuals, it is the overall establishment of a culture that supports or, indeed, institutionalizes those messages that has the best chances of success. To that end, a fundamental question that must be addressed is whether an approach connects the problem at hand to broader social forces, placing emphasis on how behavior is influenced not merely by individual reaction, but also by broader cultural patterns. This perspective means that such features must be explicitly considered in developing related policies and programs aimed at changing the traffic culture into a traffic *safety* culture. It also means moving beyond only one-on-one interventions, whether punitive or therapeutic, to look to broader notions of cultural dynamics in order to provide more effective approaches for traffic safety at individual, community, and societal levels. Thus, attention to the culture of traffic behavior as such is necessary if policies and programs are to be developed to support and promote traffic safety practices as a behavioral norm.

Keeping in mind that the efficacy of behavioral change strategies depends on consideration of the cultural context that may encourage or may hinder related efforts for change, we suggest variations on three recommendations from drug and smoking interventions to address traffic safety culture:[10]

1. High-quality, center-based education programs should be more widely implemented, and other interventions aimed at children and youth should address relevant features in the home environment, along with school and community influences.
2. Especially as regards adolescents, multilevel interventions should address social environments as they affect behavioral outcomes, including peer norms, role models, performance expectations, social supports, and ties to community institutions.
3. Interventions aimed particularly at adults should focus on the social and economic conditions that affect their attitudes and behavior.

On the one hand, these points may seem somewhat obvious. Yet, they typically are not taken directly into consideration in evaluating cultural change programs. If we are to take seriously the

10 Cf. (Smedley and Syme 2000, 10).

mandate of realizing a traffic safety culture, then it behooves us to engage such issues directly, rather than merely assume them.

Throughout this discussion, we have emphasized a longitudinal perspective in designing and assessing cultural change initiatives. A discussion of change implies attention to process and, accordingly, we have considered programs that necessarily engage their issues as subjects of process. Moreover, change maintenance requires continued reinforcement for effective institutionalization. This is a critical point that must inform the design of initiatives for establishing a traffic safety culture; that is, both short- and long-term approaches must be self-consciously employed to determine effective change relative to a traffic safety culture.

Our review of initiatives in other arenas suggests that a traffic safety culture can be facilitated by a variety of intervention approaches:[11]

- using multiple tacks (education, social support, laws, incentives, etc.), while simultaneously addressing multiple levels of influence;
- involving a variety of sectors of society (schools, law, media, business, social services, etc.) to effect broad cultural diffusion;
- focusing on generic cultural determinants of behavior, while also taking into account the special needs of target groups; and
- employing both short- and long-term perspectives, addressing both instrumental and intrinsic cultural features.

In other words, *coordinated, sustained, multilevel approaches offer the greatest promise for effecting cultural change.* Linking initiatives and providing consistent messages, support, and follow-up over time in an integrated approach across levels would seem the most effective strategy for positive behavioral outcomes.

The cultural context encompasses the social norms, attitudes, and behaviors in which people engage, which in turn directly and indirectly affect traffic outcomes. Accordingly, such factors must be treated as critical elements in designing related cultural initiatives. Legal and regulatory interventions represent a powerful tool for promoting traffic safety through social control and punitive threat. However, evaluations are needed to determine the extent to which these interventions, as such, can achieve fundamental cultural shifts. Clearly, they are not sufficient on their own. Further research in general is needed to identify and map ways in which the cultural context and related features directly and indirectly affect traffic behavior and outcomes. That is, "research is needed that will contribute to our understanding of how best to create linkages between levels of influence, and how to sequence or coordinate interventions across levels," and on the effectiveness of "intervening on additional levels in order to establish the most efficient intervention methods" (Smedley and Syme 2000, 26).

Cultural interventions can modify trajectories for traffic behavior to the extent that experiential expectations can also be changed and sustained cultural initiatives can improve extended outcomes and general expectations. Programs aimed at children and youth tend to emphasize prevention strategies in order to stop negatively defined behavior before it begins. Once it has begun, of course, it is more difficult to stop. If deeply imbued from the outset with a culture emphasizing traffic safety behavior, valuing it as desirable above conflicting imagery in society

11 Cf. (Smedley and Syme 2000, 6).

and, importantly, representing the conflicting unsafe behavior as deeply unappealing along a variety of dimensions (deglamorizing it), then a safety culture is more likely to be valued and adopted in practice. However, this image must be reinforced at every turn in order to institute what would be effectively a paradigmatic break. There are many institutionalized factors operating to maintain a glamorized and enticing image of risky traffic behavior and to prevent society from adopting a fully realized traffic safety culture. Clearly, as in the examples of anti-smoking, anti-drug, and anti-waste initiatives, a broadly encompassing multilevel and sustained approach will be required if a traffic safety culture is to flourish in the United States today.

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References

Aberg, L. 1998. Traffic rules and traffic safety. *Safety Science* 29 (3): 205–15.

Aberg, L., L. Larsen, et al. 1997. Observed vehicle speed and drivers' perceived speed of others. *Applied Psychology-an International Review-Psychologie Appliquee-Revue Internationale* 46 (3): 287–302.

American Lung Association. 2005. *State of tobacco control: 2005*. New York: American Lung Association.

Blincoe, K. M., A. P. Jones, et al. 2006. Speeding drivers' attitudes and perceptions of speed cameras in rural England. *Accident Analysis & Prevention* 38 (2): 371–8.

Castella, J. and J. Perez. 2004. Sensitivity to punishment and sensitivity to reward and traffic violations. *Accident Analysis & Prevention* 36 (6): 947–52.

Eddy, M. 2004. War on drugs: the national youth anti-drug media campaign. In *War on drugs: issues and developments*. T. P. Sholohov and F. Lamazi, eds. New York: Novinka Books, 23–30.

Evans, L. 2006. The dramatic failure of U.S. traffic safety policy: Engineering is important, public policy is crucial. *TR* 28–31.

Folz, D. H. 1991. Recycling program design, management, and participation: a national survey of municipal experience. *Public Administration Review* 51 (3): 222–31.

Gerstein, D. R. and L. W. Green, eds. 1993. *Preventing drug abuse: what do we know?* Washington, DC: National Academy Press.

Guria, J. 1998. An economic evaluation of incremental resources to road safety programmes in New Zealand. *Accident Analysis & Prevention* 31 (1–2): 91–99.

Guria, J. and J. Leung 2004. An evaluation of a supplementary road safety package. *Accident Analysis & Prevention* 36 (5): 893–904.

Hyland, A., M. Wakefield, et al. 2006. Anti-tobacco television advertising and indicators of smoking cessation in adults: a cohort study. *Health Education Research* 21 (2): 296–302.

Kluger, R. 1996. *Ashes to ashes: America's hundred-year cigarette war, the public health, and the unabashed triumph of the Philip Morris*. New York: Alfred A. Knopf.

Lomas, J. 1998. Social capital and health: implications for public health and epidemiology. *Social Science Medicine* 47 (9): 1181–8.

Loseke, D. R. 2003. *Thinking about social problems*. New York: Aldine de Gruyter.

Lynam, D. R., R. Milich, et al. 1999. Project D.A.R.E.: No effects at 10-year follow-up. *Journal of Consulting and Clinical Psychology* 67 (4).

Manski, C. F., J. V. Pepper, et al., eds. 2001. *Informing America's policy on illegal drugs: What we don't know keeps hurting us*. Washington, DC: National Academy Press.

Markle, G. E. and R. J. Troyer. 1979. Smoke gets in your eyes: cigarette smoking as deviant behavior. *Social Problems* 26 (5): 611–25.

Martin, M., I. D. Williams, et al. 2006. Social, cultural, and structural influences on household waste recycling: a case study. *Resources, Conservation, and Recycling* 48.

McKnight, A. J. and K. McPherson. 1986. Evaluation of peer intervention training for high school alcohol safety education. *Accident Analysis & Prevention* 18 (4): 339–47.

Melosi, M. V. 2005. *Garbage in the cities: refuse, reform, and the environment*. Pittsburgh, PA: University of Pittsburgh Press.

Musselwhite, C. 2006. Attitudes towards vehicle driving behaviour: Categorising and contextualising risk. *Accident Analysis & Prevention* 38 (2): 324–34.

National Research Council (NRC). 2006. *A study of interactions: Emerging issues in the science of adolescence workshop summary*. Washington, DC: National Academies Press.

Oskamp, S., M. J. Harrington, et al. (1991). Factors influencing household recycling behavior. *Environment and Behavior* 23 (4): 494–519.

Owsley, C., B. T. Stalvey, et al. 2003. The efficacy of an educational intervention in promoting self-regulation among high-risk older drivers. *Accident Analysis & Prevention* 35 (3): 393–400.

Ozkan, T., T. Lajunen, et al. 2006. Cross-cultural differences in driving behaviours: A comparison of six countries. *Transportation Research Part F: Traffic Psychology and Behaviour* 9 (3): 227–42.

Parascandola, M. 2001. Cigarettes and the US public health service in the 1950s. *American Journal of Public Health* 91 (2): 196.

Pellow, D. N. 2002. *Garbage wars: The struggle for environmental justice in Chicago*. Cambridge, MA: The MIT Press.

Perry, C. L. 2000. Preadolescent and adolescent influences on health. *Promoting health: Intervention strategies from social and behavioral research*. Smedley, B. D., and S. L. Syme. Washington, DC: National Academy Press: 217–53.

Polletta, F. 1997. Culture and its discontents: Recent theorizing on the cultural dimensions of protest. *Sociological Inquiry* 67: 431–50.

Porter, B. E. and T. D. Berry. 2001. A nationwide survey of self-reported red light running: Measuring prevalence, predictors, and perceived consequences. *Accident Analysis & Prevention* 33 (6): 735–41.

Preidt, R. 2006. Anti-smoking ads shape teen attitudes. Online: MSN Health & Fitness: Health Centers: Cancer. URL: http://health.msn.com/centers/lungcancer/articlepage.aspx?cp-documentid=100108171.

Schneider, A. and H. Ingram. 1990. Behavioral assumptions of policy tools. *Journal of Politics* 52: 510–29.

Schultz, P. W. 2002. Knowledge, information, and household recycling: Examining the knowledge-deficit model of behavior change. *New tools for environmental protection: education, information, and voluntary measures*. T. Dietz and P. C. Stern, eds. Washington, DC: National Academy Press, 67–82.

Sly, D. F., R. S. Hopkins, et al. 2001. Influence of a counteradvertising media campaign to initiation of smoking: the Florida "truth" campaign. *American Journal of Public Health* 91 (2): 233.

Smedley, B. D. and S. L. Syme, eds. 2000. *Promoting health: Intervention strategies from social and behavioral research*. Washington, DC: National Academy Press.

Sowden, A. and L. Arblaster. 2005. *Mass media interventions for preventing smoking in young people*. Cochrane Database of Systematic Reviews.

Stratton, K., P. Shetty, et al., eds. 2001. *Clearing the smoke: Assessing the science base for tobacco harm reduction*. Washington, DC: National Academies Press.

Swidler, A. 1986. Culture in action: Symbols and strategies. *American Sociological Review* 81: 273–86.

Tucker, P. and D. Speirs. 2003. Attitudes and behavioral change in household waste management behaviors. *Journal of Environmental Planning and Management* 46 (2): 289–307.

U.S. Department of Health and Human Services. 2006. *The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General*.

U.S. Department of Health Education and Welfare. 1964. *Smoking and health: Report of the Advisory Committee to the Surgeon General of the Public Health Service*. Center for Disease Control.

Vingilis, E., G. Stoduto, et al. 1994. Psychosocial characteristics of alcohol-involved and nonalcohol-involved seriously injured drivers. *Accident Analysis & Prevention* 26 (2): 195–206.

Wallack, L. 2000. The role of mass media in creating social capital. *Promoting health: Intervention strategies from social and behavioral research*. B. D. Smedley and S. L. Syme, eds. Washington, DC: National Academy Press, 337–65.

Warner, K. E. 2000. The need for and value of a multi-level approach to disease prevention: The case of tobacco control. *Promoting health: Intervention strategies from social and behavioral research*. B. D. Smedley and S. L. Syme, eds. Washington, DC: National Academy Press, 417–49.

West, S. L., and K. K. O'Neal. 2004. Project D.A.R.E. outcome effectiveness revisited. *American Journal of Public Health* 94 (6): 1027–9.

Zaidel, D. M. 1992. A modeling perspective on the culture of driving. *Accident Analysis & Prevention* 24 (6): 585–97.

Biographical statements

Connie L. McNeely (Ph.D., Sociology, Stanford University) is Associate Professor of Public Policy at George Mason University and previously served on the faculties of the University of California, Santa Barbara, and Arizona State University. In addition to numerous articles and book chapters, she is the author of *Constructing the Nation-State: International Organization and Prescriptive Action* and has an edited volume entitled *Public Rights, Public Rules: Constituting Citizens in the World Polity and National Policy.* Dr. McNeely's teaching and research addresses issues of public policy and comparative politics, culture, law and society, education, complex organizations, stratification and inequality, and social theory. She is currently completing a book entitled *Governance by the Numbers: Political and Cultural Meaning in Quantification,* and is conducting a major study on institutional dynamics affecting women and minorities in science and technology fields in higher education.

Jonathan L. Gifford (Ph.D. Civil Engineering-Transportation, University of California–Berkeley) is a professor in the School of Public Policy at George Mason University. His primary area of expertise is transportation and public policy, with a particular focus on transportation and land use. He has recently written on the 50th anniversary of the Interstate highway system in 2006 and on the policy implications of bounded rationality on transportation behavior. His book *Flexible Urban Transportation* (Pergamon 2003) examines how U.S. urban transportation policy could respond more flexibly to rapid changes in the economy and society. He has also studied the role of standards in the development and adoption of technology, particularly technological co-operation across jurisdictional boundaries through coalitions and consortia.

Traffic safety in the context of public health and medicine

David A. Sleet, T. Bella Dinh-Zarr, and Ann M. Dellinger

> *Today we can prevent, treat, or cure most of the deadliest diseases known to humankind—and yet more than a million people around the world die every year—42,000 in the U.S. alone—from traffic injuries.*
> (Sleet, Dinh-Zarr, and Dellinger 2007)

Overview

Considering motor vehicle injuries in the context of other preventable causes of death and disease helps make motor vehicle injury a salient issue in public health and preventive medicine. Framing the motor vehicle injury problem as a predictable and preventable public health problem offers health practitioners a tool to persuade the public and policy makers alike that this is an unrecognized health problem that is amenable to change. Public health's long history in advocacy for milk pasteurization, chlorination of drinking water, and other environmental safeguards can be extended to building safer roads and vehicles, The promotion of lifestyle change to reduce smoking, heart disease, and cancer prevention, can have the same appeal for changing the safety behaviors of drivers, pedestrians, and cyclists. Stimulating a culture of safety means providing safe and accessible transportation for all as a means to improve the overall quality of life for populations.

Introduction

The health of Americans changed significantly during the 20th century. In 1900, the leading causes of death were respiratory infections and diarrhoeal diseases (Ward and Warren 2007). Other infectious diseases, such as smallpox and poliomyelitis, were a constant source of dread. Public health and medical advances during the first half of the 20th century led to a dramatic fall in the death rate due to infectious diseases. Today, widespread immunization programs have virtually eliminated the threat of diseases, such as polio, diphtheria, and measles. As public health and medicine began to control infectious diseases, chronic diseases and injuries emerged as leading causes of death. Among the most important of these injuries were those related to motor vehicle travel.

This paper defines public health, describes the transportation and public health perspectives of motor vehicle safety, outlines current efforts to integrate traffic safety and public health activities in the context of a culture of safety, and discusses future research needs as transportation, public health and medicine collaborate to create a culture of safety.

Defining traffic safety as a public health problem

Public health is the science and practice of protecting and improving the health of *communities* through education, promotion of healthy lifestyles, and research on disease control, health

promotion, and injury prevention. Public health prevention measures and programs to date have been credited with 25 of the 30-year increase in life expectancy since 1900. Public health takes credit for 900,000 fewer cases of measles from 1941 to 1996; for 42 million fewer smokers from 1965 to 1996 (Association of Schools of Public Health 2006); and for saving millions of Americans who might otherwise have died from chronic diseases or injury. The three core functions of public health are consistent with efforts to reduce motor vehicle injury:

1. monitor and evaluate the health needs of communities
2. promote healthy practices and behaviors in populations; and
3. identify and eliminate environmental hazards to assure that populations remain healthy.

From the standpoint of preventable morbidity and mortality, public health has much to offer traffic safety. Public health has resources, skilled workers, and close connections to the community on matters related to health promotion and disease prevention. These features can help reduce motor vehicle injury, but only if society recognizes that injuries, like diseases, are predictable and preventable.

Motor vehicle injuries remain an enormous public health problem (Institute of Medicine [IOM] 1999). In the last 100 years, more than 2.8 million persons have died, and nearly 100 million persons have been injured on U.S. roads and highways (Department of Health and Human Services 1992). Currently, traffic injuries are the leading cause of death for children, adolescents, and young adults, and a major cause of death for all other ages. In 2005, motor vehicle crashes led to 43,443 deaths and about 2.7 million nonfatal injuries associated with more than six million police-reported crashes (National Highway Traffic Safety Administration [NHTSA] 2006). Motor vehicle injuries accounted for 22% ($89 billion) of the total lifetime costs of all injuries in 2000 (Finklestein, Corso, and Miller 2006). Blincoe et al. (2002) estimated that motor vehicle–related costs are equivalent to about $820 for each man, woman, and child in the U.S. per year and is 2.3% of the U.S. gross domestic product. Motor vehicle crash injuries on and off the job cost employers almost $60 billion (Network of Employers for Traffic Safety 2006).

Although motor vehicle crashes clearly have a health impact on individuals and society, traffic safety is often considered a transportation concern rather than a public health problem. Progress in traffic safety will be limited if this attitude prevails. As the World Health Organization attests, road safety should be viewed as a shared responsibility and not the exclusive purview of a single agency (Peden, Scurfield, Sleet, et al. 2004). Traffic crashes affect not only transportation systems, but also affect economic systems, health systems, jobs, families, and civil society. A culture of safety implies a systematic commitment by institutions, agencies, organizations, and individuals to recognize and address the unacceptable road toll and apply the best prevention strategies known to reduce it. As C. Everett Koop, MD, former US Surgeon General said about childhood injuries, “If a disease were killing our children in the proportion that accidents are, people would be outraged and demand this killer be stopped” (National SAFE KIDS Campaign 2006). This is the vision for a culture of safety—to change the public’s attitude about the unacceptable toll from traffic injuries and thereby increase our nation’s priority for road safety as a means of prevention. This action should be a social imperative.

The public health response to traffic injuries has come from different quarters—the medical profession, public health organizations, consumer advocates, and the federal health sector. The U.S. Public Health Service (PHS), part of the Department of Health and Human Services, has taken the lead within the federal health sector. Because of the enormous demands traffic injuries place on the health care system, and the significant impact of prevention programs, the PHS got

involved early in the century and has since played a critical role in organizing the public health response through epidemiology, intervention and prevention programs, public education and training, trauma care, and rehabilitation.

100 years of motoring: Uncovering the risks and protecting the public

Unlike other public health problems of the early 20th century, motor vehicle injuries and deaths are attributable to the development and rapid adoption of a new technology—the motor vehicle. In 1900, motor vehicle travel was a novelty and the risks to health and safety were largely overlooked. At that time, the motor vehicle was a major improvement over other modes of personal travel (e.g., the horse and buggy), and subsequent improvements in manufacturing made cars more affordable and available benefiting commerce, communications, and personal mobility. In 1900, an estimated 8,000 automobiles were registered in the United States. By 1950, the number of automobiles had grown to 50 million. By 2001, more than 230 million vehicles were registered , 193 million drivers were licensed and sharing roadways with an untold number of cyclists, pedestrians, and vehicle occupants. This rapid "motorization" of America brought with it increased exposure to potential risks for crashes and injuries to drivers, passengers, pedestrians, and cyclists (Global Traffic Safety Trust 1998). Over the years there were more drivers traveling roads more frequently, causing a sharp increase in deaths and injuries on the road—from 1.0 motor vehicle death per 100,000 population in 1900 to a peak of 31.0 in 1937 (National Safety Council 2002). In other words, increased mobility brought with it declines in safety. This is the paradox of motor vehicle travel in the United States and a growing problem worldwide.

The transportation perspective

The adverse consequences of increased motorization in the first few decades of the 20th century led President Herbert Hoover to convene the first National Conference on Street and Highway Safety in 1924. This was the first in a series of presidential initiatives to create a uniform set of traffic laws designed to prevent collisions and protect the public from unnecessary death and injury (American Public Health Association 1961). During 1924–1934, physicians and health practitioners participated in the national program, and formal committees were developed in all areas of traffic safety. Yet, traffic deaths continued to climb as drivers and vehicles were exposed to risks increased faster than the safety countermeasures could be designed and delivered. In 1934, 36,101 traffic-related deaths were reported (28.6 per 100,000 population). These numbers prompted President Franklin D. Roosevelt to enlist the cooperation of the governors in each of the 48 states to reduce the traffic-injury problem. In a letter to each governor on January 23rd, 1935, Roosevelt (1935) began by saying:

> *"I am gravely concerned with the increasing number of deaths and injuries occurring in automobile accidents. Preliminary figures indicate that the total of these losses during the year 1934 greatly exceeded that of any previous year. We should, as a people, be able to solve this problem which so vitally affects the lives and happiness of our citizens."*

This pronouncement and plea for involvement in traffic safety was perhaps the beginning of a culture of traffic safety in the United States. Roosevelt's letter (and subsequent action by state governors), was the genesis of the present-day Governor's Offices of Highway Safety which exist in every state to assist efforts to improve traffic safety.

In response to rising motor vehicle death rates in the early 1960s and the climate of social reform, President Lyndon B. Johnson signed two Acts in 1966: the Traffic and Motor Vehicle Safety Act and the Highway Safety Act. These Acts paved the way for an intensified effort by the government to set and regulate standards for motor vehicles and highways and to improve safety for drivers, passengers, pedestrians, and cyclists (Transportation Research Board [TRB] 1990). This legislation led to the creation of the National Highway Safety Bureau (NHSB), which in 1970 became the National Highway Traffic Safety Administration (NHTSA). Beginning with 1968 models, these two Acts gave the NHSB/NHTSA the authority to set safety standards for highways and new cars.

The systematic approach to motor vehicle-related injury prevention began with NHSB's first director, William Haddon (Institute of Medicine 1985). Haddon, a public health physician and epidemiologist, articulated a scientific approach to the prevention of motor vehicle injuries rooted in public health (Haddon 1968). Haddon's concept was built upon the work of Dr. John E. Gordon who suggested that injuries behaved like classic infectious diseases and were characterize by epidemic episodes, seasonal variation, and long-term trends. "Most important, each injury, like each disease outbreak, was the product not of one cause but of forces from at least three sources, which are the host...the agent itself, and the environment in which host and agent find themselves" (Gordon 1949). Haddon further described the factors contributing to motor vehicle injury as occurring during three phases: the precrash phase, crash phase, and postcrash phase (Haddon 1968). NHTSA's activities today continue to be influenced by Haddon's work and emphasize the importance of gaining a better understanding of the interaction between the driver, vehicle, and roadway environment.

Because of NHTSA's regulations, manufacturers began building vehicles with improved safety features such as head rests, energy-absorbing steering wheels, rollover protection, dual brakes, shatter-resistant windshields, and safety belts (TRB 1990; Rice et al. 1989). Multiple strategies were used to improve roads (i.e., environments) including better delineation of curves; the addition of edge and center-line stripes and reflectors, breakaway signs and utility poles, and highway illumination; the use of barriers to separate traffic lanes, guardrails, and grooved pavement to increase tire friction in bad weather; the practice of channeling left-turn traffic into separate lanes; the addition of rumble strips; and the availability of crash cushions on exit ramps (Department of Health and Human Services 1992; Waller 1985; Rice et al. 1989). And with time, the behavior of drivers and passengers (i.e., the host factors) changed to reduce risks related to safety belt use, drinking and driving, and speeding (i.e., the human factors) (Shinar 1978; Evans 1991). Enactment and enforcement of stricter traffic safety laws, reinforced by public education, led to personal choices favoring safety (e.g., avoiding impaired driving, waiting until age 21 to purchase alcohol, reducing speed, wearing helmets, and using child safety seats and safety belts) (Dellinger, Sleet, and Jones 2007).

Governmental recognition of the public health threat posed by motor vehicles prompted federal and state governments, academic institutions, community-based organizations, and industry to initiate safety programs. From the transportation side, NHTSA and the Federal Highway

Administration (FHWA), part of the U.S. Department of Transportation, have provided national leadership for traffic and highway safety efforts related to vehicles, driver behavior, and road environments since the 1960s—activities which continue to benefit safety today (Institute of Medicine 1999). Among the improvements in roads, the FHWA was charged with developing national standards for all traffic-control devices on any street, highway, or bicycle trail open to public travel (Federal Highway Administration 2003). Had it not been for these efforts at the Federal level to design and implement actions supporting a culture of motoring safety, the US traffic injury and death rates would surely be higher than they are today.

The public health perspective

The public health model for prevention has been applied to a wide variety of infectious and chronic diseases with remarkable success. Although many scientific disciplines, such as engineering, environmental health, and emergency medicine, have advanced our understanding of motor vehicle injury, its causes and consequences, public health has introduced the tools, methods, applications, and systems previously missing (Sleet 1987).

By definition, public health is not about individual patients—it is about populations. Public health focuses on the continuous monitoring of health, on identifying, preventing, and managing diseases and conditions affecting health, with the aim of maximizing benefits for the entire population. This is what makes public's health contribution to society unique. By necessity, public health must draw from many disciplines, such as epidemiology, health services, health promotion, behavioral science and health education, statistics, economics, and medical sociology. Unique strengths of public health include its connectedness to the community, its ability to approach health problems through a coordinated system of care, and its population focus. The population focus alone helps in the development of tools and methods used to identify, prevent, and treat illness, disease, and injury. These characteristics are embedded in the public health culture and can be successfully applied (or adapted) to the "disease" of traffic injury and to the promotion of safety.

Public health can effectively use these tools and its national infrastructure to identify, track, and monitor traffic injuries and deaths and to design short- and long-term solutions to help counter the rising exposure to traffic injury. One important tool in the fight against traffic injuries has been the use of the classic epidemiological triad used to characterize the causal nexus of disease. This triad of host (the person affected), agent (the causative element and the vehicle or vector carrying it), and the environment (conditions in which the host and agent find themselves) can be used to explain the development of smoking-related diseases as well as the factors contributing to traffic-related injury (see Figure 1). Injury results from the interaction between injury-producing **agents** (for example, kinetic energy transferred to the host when a speeding car crashes), **host** factors (a young, inexperienced driver or drinking driver), and the **environment** (road surfaces, signs, weather). Intervening on the host (changing behaviors to reduce risk), on the agent (changes in vehicle design to reduce energy transfer), or on the environment (installing dividing barriers and guardrails) can singly, or in combination, reduce the likelihood of both a crash and of the injuries that result.

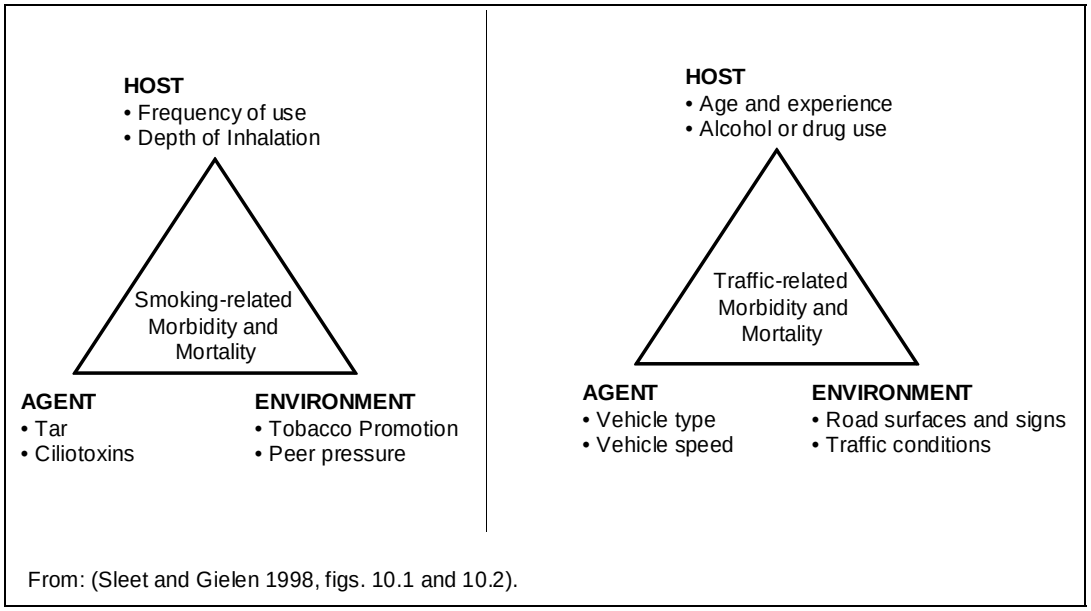

Figure 1: Interaction of factors in the epidemiological triad related to smoking and traffic safety. From Sleet and Gielen (1998, figs. 10.1 and 10.2).

The culture of safety at the Federal level got a boost when, in 1986, as a result of the National Academy of Sciences report titled *Injury in America* (Institute of Medicine 1985), Congress authorized funding to establish a national injury-prevention research program at the Centers for Disease Control and Prevention (CDC). CDC brought this public health framework and epidemiological perspective to motor vehicle injury prevention. The four-step model includes documenting the magnitude of the problem using surveillance; identifying risk and protective factors for crashes and injuries; developing and testing interventions to reduce the risk factors; and implementing and disseminating programs found to be effective (Figure 2). This model was directly applied to traffic safety programs with an emphasis on moving from initially defining the problem to responding with a preventive solution, in a sequential manner. CDC funded state and local health departments to conduct motor vehicle injury prevention programs using this model as a framework (Sleet, Bonzo, and Branche 1998). In addition, CDC funded "Centers of Excellence" to conduct injury control research, with the initial requirement that half of the money be spent on research related to motor vehicle injury prevention and control. Today, many of these centers continue to conduct important motor vehicle-related research with funding from CDC.

State health departments, partly due to having carried out disease prevention and health promotion activities, have an important contribution to promoting a culture of safety. Resources to carry out that role, however, have been lacking. Most state funding for traffic safety programs has come from state offices of highway safety, funded by NHTSA, which provides a steady stream of safety funds based on the number of highway miles in the state. However, because of their unique role in protecting and promoting the health of state and local populations, health departments should be key components in any effort to reduce traffic injuries. Health departments have the statutory responsibility for public health, provide community health services, deliver programs to underserved populations, and are typically experienced in working with a broad range of community groups and agencies (Sleet 1990). Preventing injuries related to motor

vehicle crashes (e.g., alcohol-impaired driving, safety belt use, pedestrian and bicycle safety) is seen as an increasing responsibility of the health sector.

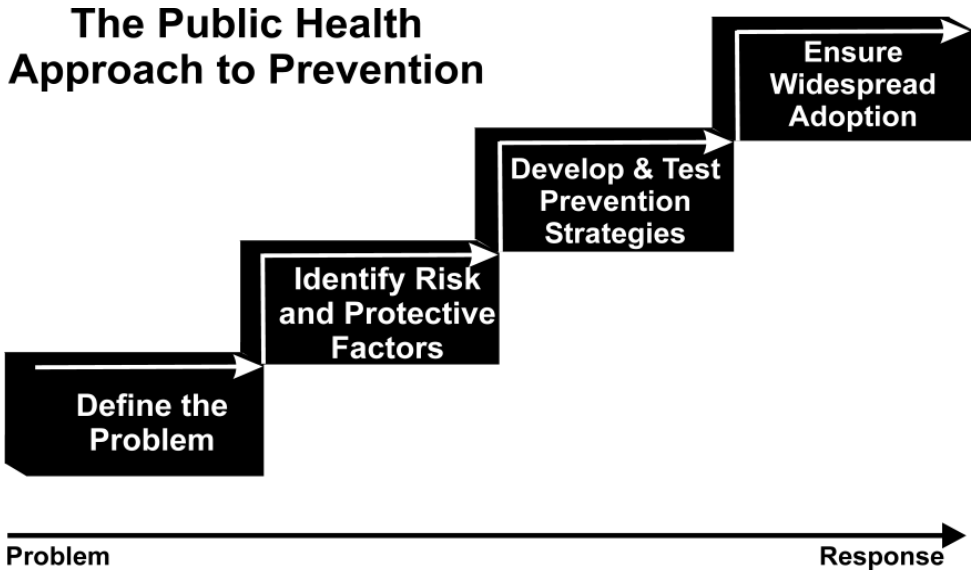

Figure 2: The public health approach to prevention.

Other important contributors to the culture of safety have been the private sector, voluntary organizations, and nonprofit groups like SafeKids Worldwide, and the Association for Safe International Road Travel (ASIRT). Advocacy groups like Mothers Against Drunk Driving (MADD), Physicians for Auto Safety, Advocates for Auto and Highway Safety, the Insurance Institute for Highway Safety, and the AAA Foundation for Traffic Safety have stimulated public debate, encouraged legislation and public policy, supported victim rights, and sponsored research. Such efforts, along with those of federal and state public health agencies and heath and medical groups, have created a sea change in public interest and political action toward a culture of safety.

Collaboration within public health and medicine

In many respects the collaboration between traffic safety and public health about motor vehicle injury prevention stems from a common vision. Although the language and systems for addressing the problem may differ, both fields offer important and unique perspectives. Whereas each has influenced its own sector differently, the collective action has influenced the entire culture of safety.

Collaboration within the medical professions—particularly among physicians who treat crash victims—has contributed to the development of a culture of safety in large part because their collective views represent the voices of many thousands of their members. As early as 1950, both the American Medical Association and the American College of Surgeons had recommended that automobile manufacturers design cars for passenger safety and install them with safety belts. In

1961, the American Public Health Association in collaboration with the U.S. Public Health Service's Division of Accident Prevention, published *Accident Prevention: The Role of Physicians and Public Health Workers* (American Public Health Association 1961). At that time, the National Safety Council, the President's Committee for Traffic Safety, and the U.S. Public Health Service were all collaborating to reduce the unacceptable rise in traffic injury. Yet, Dr. Paul V. Joliet, then Chief of the Accident Prevention Program of the Public Health Service, cautioned his colleagues that "There are no simple easy solutions (to the traffic injury problem)" (FHWA 2006).

Ten years later, in what was called "an avant-garde medical text," Roberts (1971) published a 1,000 page book on *The Causes, Ecology and Prevention of Traffic Accidents*, thanks to contributions from leaders in the American Association for Automotive Medicine, Physicians for Automotive Safety, and the International Association for Accident and Traffic Medicine. More recently, professional associations, such as the American College of Preventive Medicine, the American Trauma Society, the International Union for Health Education, the Society for Public Health Education, and the American Public Health Association, have adopted resolutions dedicating their leadership and professional members to promote highway and vehicle safety as a health issue and integrating traffic safety into their prevention efforts.

Today, collaboration abounds, particularly on the international front. The World Health Organization's *World Report on Road Traffic Injury Prevention* (Peden et al. 2004) and subsequent World Health Day in 2004 dedicated to "Road Safety is No Accident" helped engender an international climate for a culture of road safety with recommended actions to propel international unity around the problem. Also in 2004, after nearly 30 years of silence on the topic, the 57th World Health Assembly overwhelmingly adopted Resolution 57/10 on Road Safety and Health, calling for, among other actions, "multi-sector coordination" and collaboration. These collaborative efforts, over time, have fostered and will sustain efforts to build a culture of traffic safety within public health and medicine, reinforcing the perception that traffic safety and traffic injury prevention are (or should be) priority social and health goals in a civil society. Changes in traffic safety laws, public perceptions of vehicle safety, and enhanced enforcement have led toward cultural intolerance of reckless driving, drinking and driving, and nonuse of safety belts, which have contributed to social norms favoring safety. It has taken a long time, but this collaboration demonstrates that with political will, cooperation from industry, social commitment, and public participation in the process, traffic injury prevention is achievable.

Progress toward the goal

Public Health's contribution to injury prevention has been multidisciplinary and directed toward collective action (Fisher 1988). Public health functions that have served the goals of motor vehicle injury prevention include assessment (monitoring health behaviors and identifying community health hazards), assurance (enforcing laws and regulations that protect people from injuries and linking people to needed prevention and trauma care), and healthy policy (developing policies and plans that support healthy environments and behaviors conducive to motor vehicle injury prevention). Although most of what public health accomplishes is in prevention,

important advances also have been made in improving emergency medical services and developing, implementing, and evaluating comprehensive trauma care systems. By minimizing the consequences of an injury, these components of "tertiary" prevention are also characteristic of a culture of safety.

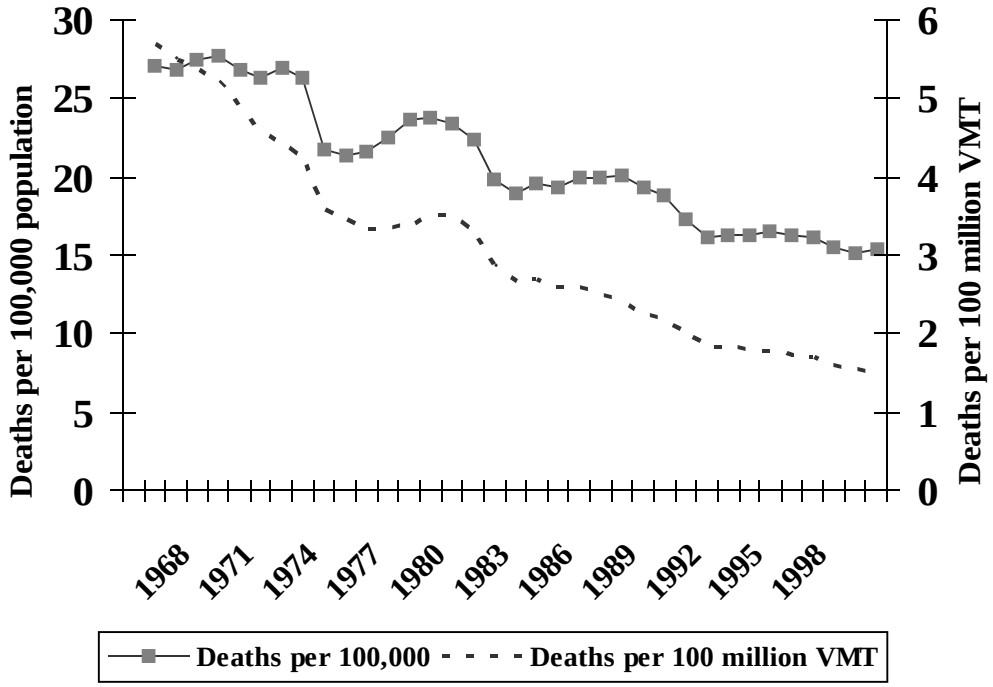

Figure 3. Motor vehicle death rates per 100,000 population and per 100 million vehicle miles traveled, 1966–2000—United States. Derived from National Safety Council data in Injury Facts (2002 edition), Itasca, IL.

Since 1966, the combined efforts of government and private agencies and organizations to reduce motor vehicle fatalities have resulted in a 43% decrease in the rate of deaths per 100,000 population and a 72% decrease in deaths per vehicle miles traveled [VMT] (Figure 3). These reductions translate into more than 250,000 lives saved and countless injuries averted. (National Safety Council 2002). These gains are from changes in driver behavior, vehicle design, and road design that have improved both individual mobility and population safety. The reduction in U.S. motor vehicle death rates, especially in the wake of ever-increasing motorization, shifting demographics, and changing social patterns, is evidence of the growing culture of safety promulgated by both public health and traffic safety activities during the past four decades. In fact, the CDC included motor vehicle safety as one of the 10 significant public health achievements of the 20th century (CDC 1999) and it is now considered one of the "silent victories" in the history and practice of public health in 20th century America (Dellinger, Sleet, and Jones 2007). Nonetheless, more work remains to be done, and future efforts must involve increasingly close collaboration among practitioners in traffic safety, public health, and medicine.

Healthy People 2010

Adding to the significant milestones contributing to the culture of traffic safety are the directions set by the U.S. Department of Health and Human Services (DHHS) (2000) in its policy framework *Healthy People* and *Objectives for the Nation*. DHHS also developed another set of national goals: *Healthy People 2010*. Together, these goals aim to improve the country's health by reducing preventable health threats. Public health professionals at local, state, and national levels work to meet and exceed these goals through public health interventions and policy changes.

Table 1: Examples of Healthy People 2010 motor vehicle–related objectives. From U.S. Department of Health and Human Services (2000).

Number	Objective	1998 Baseline	2010 Target
15-15	Reduce deaths caused by motor vehicle crashes	15.6 deaths per 100,000 population 1.6 deaths per 100 million vehicle miles traveled	9.2 deaths per 100,000 population 0.8 deaths per 100 million vehicle miles traveled
15-16	Pedestrian deaths	1.9 pedestrian deaths per 100,000 population	1.0 pedestrian death per 100,000 population
15-17	Nonfatal motor vehicle injuries	1,181 nonfatal injuries per 100,000 population	933 nonfatal injuries per 100,000 population
15-18	Nonfatal pedestrian injuries	26 nonfatal pedestrian injuries per 100,000 population	19 nonfatal injuries per 100,000 population
15-19	Safety belts	69 % of total population	92%
15-20	Child restraints	92% of children 4 years or younger	100%
15-21	Motorcycle helmet use	67% of motorcycle operators and passengers	79%
15-22	Graduated driver licensing model law	23 states (in 1999)	All states and the District of Columbia
15-24	Bicycle helmet laws	10 states had laws requiring bicycle helmets for cyclists under the age of 15 years (in 1999)	All states and the District of Columbia

In 1979, the U.S. Department of Health, Education, and Welfare (now the Department of Health and Human Services) identified motor vehicle trauma as a major public health problem (U.S. Department of Health, Education, and Welfare 1979) and developed specific health objectives for the nation to reduce the injury burden by 1990. These objectives were reviewed and expanded in 1990, and again in 2000, with a new set of motor vehicle–related goals and targets for the year 2010. *Healthy People 2010* includes specific objectives for decreasing motor vehicle and pedes-

trian-related deaths and injuries; increasing the use of safety belts, child restraints, and motorcycle and bicycle helmets; and implementing graduated driver licensing laws and bicycle-helmet legislation (see Table 1). Other objectives (not listed) specify goals to reduce nonfatal head trauma and spinal cord injury hospitalizations and to increase the use of alternative modes of transportation (U.S. Department of Health and Human Services 2000).

The CDC is the lead public health agency for establishing and tracking objectives related to injuries. The National Highway Traffic Safety Administration has been an essential partner in these efforts by helping set targets and monitoring data about the motor vehicle injury problem since the inception of *Healthy People* in 1979.

Future challenges and opportunities

Despite substantial gains in motor vehicle injury prevention in the past 100 years, crashes and resultant injuries remain a major public health problem well into the 21st century. The possibilities for integrated research and cooperative programs of surveillance, intervention and evaluation between traffic safety and public health are almost limitless.

In the future, motor vehicle travel will contribute to a number of crosscutting health problems—from personal safety to concerns over obesity and environmental pollution. These problems will be compounded as travel increases, populations grow, society ages, and reliance on cars increases. Most importantly, the costs and burdens associated with the more than 3,000 deaths, millions of injuries, and annual costs for care and rehabilitation, cannot be sustained by society for much longer.

Conflict has always existed between the goals of mobility and the goals of safety and this balance must be continually reevaluated. For example, although the national 55 mph speed limit was instituted to conserve fuel, it also resulted in fewer crashes and fewer crash deaths. When fuel availability increased, so did speeds and road deaths. This illustrates the trade-off between one aspect of mobility (speed) and traffic safety. Evidently, the public was not willing to maintain restricted mobility despite the substantial safety benefits. By strengthening a culture of safety, this viewpoint can be changed to embrace safety.

Additionally, new conflicts are emerging between “automobility” and the goals of traffic safety and public health. For example, parents are encouraged to increase physical activity for children by promoting walking, but because of traffic safety or security concerns, they may be reluctant to allow their children to walk near traffic, even short distances. Adults themselves may struggle with the choice of walking or cycling instead of driving to work. Fuel-efficient cars may be better for the environment and contribute less to conditions such as asthma, which achieves one public health goal, but driving a fuel-efficient car does not reduce the risk of cardiovascular disease or promote health and fitness, which is another public health goal (Kelter 2006). Such conflicts will present unique challenges that must be addressed thoughtfully and from a broad perspective as we move forward toward an integrated safety culture.

As new technologies are incorporated into vehicles, drivers will face new behavioral and attention demands (Waller 2001; Porter and Bliss 2006). Distractions such as cell phones, in-vehicle entertainment systems, and vehicle-equipped Internet and global positioning systems pose problems that could undermine a culture of safety. Rises in traffic volume and congestion can be expected, along with changes in the ratio of small vs. large vehicles. Computerized in-vehicle early-warning systems to detect an imminent crash also present new safety challenges that will require innovative solutions. Safety gains derived from making cars safer, reducing alcohol-impaired driving and speeding, and increasing safety belt use may be offset by new hazards related to driver distraction, fatigue, or sensory overload. The cry for more efficient mobility will have to be tempered with the need for more safety as the culture of technology (gadgets) begins to overtake the culture of safety.

Special populations will continue to be a focus of research. Interventions to reduce alcoholism and problem drinking at the population level should continue, as should targeting "binge" drinking and hard-core drinking drivers. These efforts will benefit traffic safety. Teen driving risks will continue to be a problem, as cohorts of new inexperienced drivers are added to the driving mix. Research on the effectiveness of graduated drivers licensing programs will remain important, as will improvements in driver education and training. Because neuroscience continually reveals new information about the adolescent brain, the cognitive aspects of adolescent driving will play an increasingly important role in research.

As the population ages, crash and injury prevention; among older drivers will become a higher priority. Adults over age 65 are expected to double by the year 2030 (U.S. Census Bureau 2003). Because people are living longer, older persons will be driving longer, increasing their exposure to crashes and injuries. Assisting older adults in successfully balancing safety and mobility will be an important challenge and will involve commitment from health, social services agencies, and traffic safety agencies and advocates. Changes to consider involve the vehicle (e.g., safety belts that are easier to reach, visual displays that are easier to read, pedals that are easier to reach and depress); the roadway (e.g., signs that are easier to read, junctions that are easier to navigate); and driver behavior (e.g., improved functional screenings and assessments of older adults to identify those who should be monitored or stop driving). The availability of practical alternative transportation options for older adults should be a high priority as their needs for greater mobility expand with increased longevity.

Immigration will also bring new challenges to traffic safety, as transplanted drivers and pedestrians carry with them their own cultural patterns of walking and driving. Many of these may be incompatible with a culture of safety. Traffic safety and public health will need to work together to determine how population changes will impact traffic safety and the health of future generations and to assure diverse populations stay safe while mobile.

With so many challenges facing traffic safety and injury control, a comprehensive approach is vital. Our whole culture of safety must be improved, rather than simply addressing individual traffic safety issues as they arise. There remains a critical need to support training for new researchers and practitioners in safety culture and to broaden the public health implications of the traffic safety problem (Waller 2001).

How public health can create a culture of safety

The greatest successes in public health have resulted from cultural change (Ward and Warren 2007). For example, smoking was once considered harmless and part of a healthy and active lifestyle. In the 1930s, cigarette advertisements in the United States often showcased physicians and athletes as spokespersons. With mounting scientific evidence on the hazards of smoking and a shift from emphasizing dangers to the smoker to dangers to the nonsmoker, the public began viewing smoking negatively and health culture was permanently changed. Likewise, creating a safety culture will require a shift in how we think about traffic hazards, personal risk behaviors, and the value of prevention.

Public health can contribute to this shift by:

- Including road safety in health promotion and disease prevention activities.
- Incorporating safety culture into health education activities for adolescents so that they associate safety with all aspects of life.
- Requiring safety impact assessments similar to environmental impact assessments (i.e., before new roads are built).
- Using public health tools to help the transportation sector in conducting safety audits to identify unsafe roads and intersections.
- Incorporating safety and mobility into healthy aging—for example, by focusing on the mobility needs of older adults, especially as they relinquish their driving privileges.
- Applying modern evaluation techniques to measure the impact of road safety programs and injury prevention interventions.
- Measuring health care costs and public health consequences of traffic injuries.
- Assisting states and communities with local injury data collection and traffic-injury surveillance systems.
- Reducing health disparities by assuring equal access to community preventive services such as child safety seats, bicycle helmets, and neighborhood sidewalks for poor or underserved populations.
- Strengthening pre-hospital and hospital care for trauma victims by supporting comprehensive trauma care systems, nationwide.

Public health cannot do this alone. Other sectors in society must be encouraged to participate (i.e., education, transportation, business, economics, justice, and social services). Using a multidisciplinary perspective, traffic safety and health can move into urban planning, the built environment, social ecology, road administration, injury surveillance, and social marketing as necessary extensions of their work to preserve health and safety.

Comprehensive, integrated public health surveillance systems will be needed that can provide policy makers, planners, and public health officials at the state and local levels with timely data

on crashes, injuries, and deaths. This will enable them to set realistic priorities and implement prevention strategies in the midst of other competing priorities (Holder, Peden, Krug, et al. 2001; Thacker et al. 1996; Espitia-Hardeman and Paulozzi 2005).

On the intervention side, we know that because the conditions that give rise to motor vehicle injuries are complex with multiple and interrelated causes; therefore, interventions will have to be comprehensive and tailored (Dellinger et al. 2007). Prevention efforts in most areas of public health benefit from an approach that relies on the combination of multiple interventions. Health promotion provides a useful framework for accomplishing this because it relies on a combination of approaches (Sleet 1984, 1989; Lonero et al. 2006). Interventions considered part of the health promotion approach include: economic interventions, organizational interventions, policy interventions, environmental supports, and health education interventions, including the use of media, school and community education and public awareness programs (Howat, Sleet, Elder, et al. 2004). Integrating health promotion approaches so successfully used for tobacco control and chronic disease prevention into motor vehicle injury prevention is likely to advance efforts to build a culture of safety on the highway, at school, in the home, at work, in the doctor's office, and in the community.

One of the remaining obstacles is the public's misconception that injuries are accidents that occur by chance. It has been difficult to summon popular sentiment for motor vehicle injury because there is no single cause or cure, it is not widely recognized as a public health problem, and most people consider injury the result of an uncontrollable "accident." For many, road trauma is simply the price we pay for mobility. Whereas some progress has been made toward changing public perception about the predictability of injury and its preventable nature, more must be done.

Public health professionals have been successful in framing motor vehicle injuries in the context of other preventable causes of death and disease. The medical professions have been quick to recognize their role as advocates for motor vehicle safety with patients and policy makers and the importance of emphasizing lifestyle changes that include safety behaviors. By framing motor vehicle injury as predictable and preventable health practitioners will have a tool to educate the public and influence policy makers about a serious public health problem that can be reduced, just like many diseases. A culture of safety that provides for safe and accessible transportation can prevent injury and death and improve the overall quality of life for populations. Put in the context of national health objectives, by improving traffic safety we also improve public health.

Disclaimer

The information provided in this article/chapter does not necessarily represent the official views or policies of the U.S. Department of Health and Human Services (HHS) and the Centers for Disease Control and Prevention (CDC). The inclusion of individuals, programs or organizations in this article/chapter does not constitute endorsement by the federal government, HHS or CDC.

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References

American Public Health Association. 1961. *Accident prevention: The role of physicians and public health workers*. New York: McGraw-Hill Book Company, Inc., 127.

Association of Schools of Public Health. 2006. *What is public health?* Available online at: http://www.asph.org. (accessed August 18, 2006).

Blincoe, L. J., A. G. Seay, E. Zaloshnja, T. R. Miller, E. O. Romano, S. Luchter, and R. S. Spicer. 2002. *The economic impact of motor vehicle crashes 2000*. National Highway Traffic Safety Administration, US Department of Transportation, Report No. DOT HS 809 446, May 2002.

Centers for Disease Control and Prevention (CDC). 1999. Motor vehicle safety: A 20th century public health achievement. *MMWR* 48 (18): 369–74.

Dellinger, A., D. A. Sleet, and B. H. Jones. 2007. Drivers, wheels, and roads: Motor vehicle safety in the twentieth century. In J. Ward and C. Warren, eds. *Silent victories: The history and practice of public health in twentieth-century America*. New York: Oxford University Press.

Dellinger, A., D. A. Sleet, R. Shults, and C. Rinehart. 2007. Preventing motor vehicle-related injuries. Chapter 10. In L. Doll, S. Bonzo, J. Mercy, and D. Sleet, eds. *Handbook of injury and violence prevention*. New York: Springer.

Department of Health and Human Services, Public Health Service. 1992. Position papers from the *Third national injury control conference: Setting the national agenda for injury control in the 1990s*. Washington, DC: Government Printing Office, DHHS Pub. No. 1992-634–66.

Espitia-Hardeman, V., and L. Paulozzi. 2005 *Injury surveillance training manual.* National Center for Injury Prevention and Control. Centers for Disease Control and Prevention, Atlanta GA.

Evans, L. 1991. *Traffic safety and the driver.* New York: Van Nostrand Reinhold.

Federal Highway Administration. 2003. *Manual on uniform traffic control devices for streets and highways*. Washington, DC: US Department of Transportation (in accordance with Title 23 US Code, Sections 109(d), 114(a), 217, 315, and 402(a), 23 CFR 655, and 49 CFR 1.48(b)(33) and 1.48(c)(2).

———. 2006. *President Dwight D. Eisenhower and the federal role in highway safety.* (Chapter 3: Maintaining the focus). From www.fhwa.dot.gov/infrastructure/safety03.hhtm (accessed September 3, 2006).

Finklestein, E., P. S. Corso, and T. R. Miller. 2006. *The incidence and economic burden of injuries in the United States*. New York: Oxford University Press.

Fisher, L. 1988. Childhood injuries—causes, preventive theories and case studies: An overview on the role for sanitarians and other health professionals. *Journal of Environmental Health* 50 (6): 355–60.

Global Traffic Safety Trust. 1998. *Reflections on the transfer of traffic safety knowledge to motorizing nations*. Melbourne, Australia: Global Traffic Safety Trust.

Gordon, J. E. 1949. The epidemiology of accidents. *Am J Public Health* 39:504–15.

Haddon, W. 1968. The changing approach to the epidemiology, prevention, and amelioration of trauma: The transition to approaches epidemiologically rather than descriptively based. *Am J Public Health* 58:1431–8.

Holder, Y., M. Peden, E. Krug, et al., eds. 2001. *Injury surveillance guidelines*. Geneva, World Health Organization.

Howat, P., D. A. Sleet, R. Elder, and B. Maycock. 2004. Preventing alcohol-related traffic injury: A health promotion approach. *Traffic Injury Prevention* 5:208–19.

Institute of Medicine (IOM). 1985. *Injury in America: A continuing public health problem*. Washington, DC: National Research Council, Institute of Medicine. National Academy Press.

———. 1999. *Reducing the burden of injury: Advancing prevention and treatment*. Washington DC: Committee on Injury Prevention and Control, Division of Health Promotion and Disease Prevention. National Academy Press.

Kelter, Alexander. 2006. *Think medically, act socially.* Presentation at New Partners for Smart Growth 5th Annual Conference, Denver, Colorado. January 26, 2006.

Lonero, L., K. Clinton, and D. A. Sleet. 2006. Behavior change interventions in road safety. Chapter 10. In A. C. Gielen, D. A. Sleet, and R. DiClemente, eds. *Injury and violence prevention: Behavior change theories, methods and applications*. San Francisco, CA: Jossey-Bass, pp. 213–33.

National Highway Traffic Safety Administration (NHTSA). 2006. *Motor vehicle traffic crash fatality counts and estimates of people injured for 2005*. DOT HS 810 639, August 2006.

National Safety Council (NSC). 2002. *Injury facts, 2002 edition*. Itasca, Illinois: National Safety Council.

National SAFE KIDS Campaign Washington, DC. As quoted from: www.blythedale.org/health/safe_kids.asp (accessed September, 2006).

Network of Employers for Traffic Safety. Quoted from: www.trafficsafety.org/cost_of_crashes.asp (accessed October 1, 2006).

Peden, M., R. Scurfield, D. Sleet, D. Mohan, A. A. Hyder, E. Jarawan, and C. Mathers. 2004. *World report on road traffic injury prevention*. Geneva: World Health Organization.

Porter, B. E., and J. P. Bliss. 2007. Human Factors in Product and Environmental Design for Injury Control. In A. C. Gielen, D. A. Sleet, and R. DiClemente, eds. *Injury and violence prevention: Behavior change theories, methods and applications*. San Francisco, CA: Jossey-Bass, pp. 467–84.

Rice, D. P., E. J. MacKenzie, A. S. Jones, et al. 1989. *Cost of injury in the United States: A report to Congress*. San Francisco, CA: University of California, Institute for Health and Aging; Johns Hopkins University, Injury Prevention Center.

Roberts, H. J. 1971. *The causes, ecology and prevention of traffic accidents*. Springfield: Illinois, Charles C Thomas Publisher.

Roosevelt, F. D. 1935. A plea for state cooperation to reduce automobile accidents. January 24, 1935. In *Roosevelt, Franklin D. Public Papers and Addresses of Franklin D. Roosevelt*, vol. 4, pp. 62–63. New York: Random House, 1938. (Courtesy of Franklin D. Roosevelt Library, Hyde Park, New York).

Shinar, D. 1978. *Psychology on the road*. New York: John Wiley & Sons.

Sleet, D. A., B. Dinh-Zarr, and A. Dellinger. 2007. Traffic safety in the context of health and medicine. In *Improving traffic safety culture in the U.S.: The journey forward*. Washington, DC: AAA Foundation for Traffic Safety.

Sleet, D. A., ed. 1984. Occupant protection and health promotion. *Health Education Quarterly* 11 (2).

———. 1987. Motor vehicle trauma and safety belt use in the context of public health priorities. *J Trauma* 27 (7): 695–702.

———. 1989. Drinking, driving and health promotion. *Health Education Quarterly* 16 (3) Fall.

———. 1990. *Reducing traffic injuries in America: U.S. objectives and strategies*. Proceedings of Inaugural Conference of Roadwatch. Perth, Australia: Road Accident Prevention Research Unit, University of Western Australia–Perth, 31–46.

Sleet, D. A., S. Bonzo, and C. Branche. 1998. An overview of the national center for injury prevention and control at the centers for disease control and prevention. *Injury Prev* 4 (4): 308–12.

Sleet, D. A., and A. Gielen. 1998. Injury prevention. In J. Arnold and S. Gorin, eds. *Health Promotion Handbook*. St Louis, MO: Mosby, 247–75.

Thacker, S. B., D. F. Stroup, R. G. Parrish, and H. A. Anderson. 1996. Surveillance in environmental public health: Issues, systems, and sources. *Am J Public Health* 86:633–8.

Transportation Research Board (TRB). 1990. *Safety research for a changing highway environment*. Washington, DC: National Research Council, Transportation Research Board, Special Report 229.

U.S. Census Bureau. 2003. *Population projections program*. Population Division. Washington, DC: Bureau of the Census. Available from: URL: www.census.gov/population/projections/nation/summary/ (accessed September 2003).

U.S. Department of Health and Human Services. 2000. *Healthy People 2010.* 2nd ed. (with understanding and improving health and objectives for improved health). 2 vols. Washington, DC: Government Printing Office.

U.S. Department of Health, Education and Welfare. 1979. *Healthy People: The Surgeon General's report on health promotion and disease prevention*. DHEW (PHS) Publication No. 79-55071, U.S. Government Printing Office.

Waller, J. 1985. *Injury control: A guide to causes and prevention of trauma*. Lexington, KY: D.C. Heath & Co.

Waller, P. F. 2001. Public health's contribution to motor vehicle injury prevention. *Am J Prev Med* 2001 21 (4S): 3–4.

Ward, J. W., and C. Warren, eds. 2007. *Silent victories: The history and practice of public health in twentieth-century America*. New York: Oxford University Press.

Biographical statements

David A. Sleet, Ph.D., FAAHB, is the Associate Director of Science for the Division of Unintentional Injury Prevention at the Centers for Disease Control and Prevention (CDC) in Atlanta. He is the senior adviser to the division on matters of science and policy, and has published over 160 articles, book chapters, and reports on injury prevention and health promotion. Before joining CDC, he was a professor at San Diego State University where he helped found the Graduate School of Public Health. He was a research fellow at the National Highway Traffic Safety Administration in Washington, D.C., the Road Accident Research Unit in Perth, Australia, the Road Transportation and Geotechnical Laboratory in Espoo, Finland, and the Vrije Universiteit in Brussels, Belgium. His recent awards include the American Public Health Association's Mayhew Derryberry Award for theory contributions, the U.S. Department of Health and Human Services Achievement Award for research on alcohol-impaired driving, the NHTSA Administrators Award for research on "best practices" for traffic injury interventions, and the MADD President's Award for Research reducing drunk driving. He is coeditor of the *World Report on Road Traffic Injury Prevention* (WHO 2004), and author of 3 books, including *The Handbook of Injury and Violence Prevention* (Springer 2007) and *Injury and Violence Prevention: Behavioral Science Theories, Methods, and Applications* (Jossey-Bass 2006). He is a Fellow of the American Academy of Health Behavior.

T. Bella Dinh-Zarr, Ph.D., M.P.H., is a public health and transportation consultant, currently acting as the North American Director of the *Make Roads Safe* international road safety campaign, an initiative of the FIA (Fédération Internationale de l'Automobile) Foundation for the Automobile and Society. Previously, she served as the National Director of Traffic Safety Policy for the American Automobile Association (AAA) where she created innovative programs for the older population (Roadwise Review, CarFit) and facilitated AAA Club activities in diverse areas of traffic safety and public health, including occupant protection and alcohol-impaired driving. Born in Vietnam, she is a graduate of Rice University in Texas, studied at La Universidad Católica de Valparaíso in Chile, and earned Master of Public Health and Ph.D. degrees from the University of Texas. Dr. Dinh-Zarr has held positions with the U.S. National Highway Traffic Safety Administration, the Cochrane Collaboration Injury Group in London, U.S. Centers for Disease Control and Prevention, Texas Transportation Institute, and RDI Southeast Asian refugee services agency. In 2005, she received a U.S. Presidential Appointment to the White House Conference on Aging Advisory Committee. Dr. Dinh-Zarr is a member of various Transportation Research Board Committees, has testified before the U.S. Congress on road safety, and has appeared on media outlets in the U.S. and abroad. She speaks English, Spanish, and Vietnamese.

Ann M. Dellinger, Ph.D., M.P.H., serves as epidemiologist and team leader, Motor Vehicle Injury Prevention Team of the CDC's National Center for Injury Prevention and Control. She holds a B.S. degree (biology) from the University of San Diego, an M.P.H. degree (health promotion) from the Graduate School of Public Health at San Diego University, and a Ph.D. degree (epidemiology) from the University of California, at Los Angeles. Dr. Dellinger currently conducts several studies in the area of motor vehicle safety focusing on older drivers, child occupant and pedestrian injury, and injury risk behavior.

The making of driving cultures

Jane Moeckli

National Advanced Driving Simulator
The University of Iowa

John D. Lee

Department of Mechanical and Industrial Engineering
and the National Advanced Driving Simulator
The University of Iowa

Overview

Culture matters. It is the mechanism through which we come to understand ourselves and our relationship to the world. In the U.S., cars and driving are intimately connected to our individual and collective sense of self—who we are, what we believe, value, and aspire to achieve, and how we interact with others. From the promise of Herbert Hoover's 1928 presidential campaign slogan, "a chicken in every pot and a car in every garage," to conflicting portrayals of the sport utility vehicle as a means to experience nature or as a "gas guzzling" status symbol, the car and driving have always referenced the American experience of and desire for freedom, individualism, self-realization, prosperity, and progress.

Culture is also inherently material, accounting for how groups identify themselves and interact with their environment through developing, building, and using artifacts. A car's design is as much a response to drivers' fantasies of power, control, and speed as it is to the utilitarian components of travel. The choice to drive is affected by people's beliefs and values regarding appropriate uses of vehicles and the resources required to operate them. And driving itself changes how people understand time and space, altering their perception and experience of distance. Cars as material objects and driving as an embodied experience, therefore, reflect and reinforce our cultural identity.

The preeminence of cars and driving in American culture makes the relative silence on the high number of deaths and injuries due to car crashes a perplexing phenomenon. Although total U.S. fatalities from recent high-profile catastrophes—the Oklahoma City bombing, shootings at Columbine High School, terrorist attacks on September 11, 2001, and Hurricane Katrina—combined have numbered less than 5,000, these deaths and the events that caused them have had considerable influence on the American political, economic, and cultural landscapes. In contrast, the 42,636 lives lost in 2004 *alone* as a result of vehicle crashes on U.S. roadways barely registered in the collective consciousness of the American public. How can we lose an average of 116 lives *each day* in crashes that are largely preventable and not have more public outcry, media coverage, and government intervention?

Our apparent complacency—both individual and organizational—presents a clear challenge that may best be addressed by approaching driving and traffic safety as effects of culture. In order to understand culture's role in shaping driving behavior, however, we must first critically reflect on the concept of "culture." What is culture? Can it change? Who is involved in its construction? In

this chapter, we make the case for an explicitly theorized notion of culture. We argue that how the traffic safety community defines culture dictates courses of action taken in the effort to decrease fatalities, injuries, and property loss. We begin by exploring how a focus on culture fits relative to more typical approaches to driving safety research, as well as to research on cars and mobility. Then we reflect on the idea of culture, outlining current debates over its use. Finally, we suggest four theoretical approaches to culture that we believe are critical to any discussion about traffic safety. It is our hope that these suggestions will expand the definition of culture to better address issues specific to driving. We conclude with recommendations for putting theorized driving culture into action.

Culture and driving safety

A focus on culture contrasts with more typical approaches to driving safety. Historically, designers and policy makers have assumed that mishaps are bound to occur, and that they should thus concentrate on increasing the crash-worthiness of vehicles (Evans 2004). Recently, safety interventions have considered the limits of drivers' perceptual, cognitive, and motor abilities that may constrain their performance when responding to roadway demands (Lee 2006). Interventions include collision warning systems and vehicle control systems designed to compensate for these limits of driver performance.

Driver performance, however, fails to address factors such as attitudes, goals, and priorities of drivers, which have a significant influence on driving safety (Evans 1991). Attitudes and traits are identified by focusing on driver behavior rather than on performance. Research in this area represents an important contribution to understanding driver crash involvement (Parker et al. 1992). For example, most drivers can maintain their speed within the posted speed limits; however, severe crashes often occur when drivers deliberately choose to exceed the speed limit (Reason et al. 1990). Likewise, young drivers have shorter reaction times than older drivers but crash more frequently; in other words, they perform better but, for various reasons, behave worse (Evans 2004).

Driver behavior has been extensively analyzed using surveys such as the Driver Behaviour Questionnaire (DBQ) that identify types of drivers who are disproportionately likely to be involved in crashes. Several large surveys and associated factor analyses have shown that three distinct patterns of behavior have a powerful influence on driver safety: (1) lapses or absentminded behavior, (2) errors caused by misjudgment of danger or failures of observation, and (3) violations or deliberate neglect of the conventions of safe driving (Blockey and Hartley 1995; Parker et al. 1995).

Research on driver behavior has focused almost entirely on individual differences as contributors to unsafe driving behavior. The fivefold difference in the rate of fatalities between states in the U.S. and the thousandfold difference in this measure between countries, however, suggests culture has an important influence on driving behavior, as well as playing a critical role in driving safety more generally (Lee 2006). A shift of focus to the cultural forces at play in the wider driving environment provides a means to address the willingness of society to invest in transportation infrastructure. A focus on culture also highlights the influence of societal expecta-

tions on the definition of acceptable transportation risks. Neither of these perspectives is possible within frameworks that focus on driver performance or behavior.

Recently, risk management researchers have recognized the prominent role safety culture plays in influencing organizational practices that lead to mishaps. As a specific example, the Barrings financial catastrophe appears on the surface to be a result of the actions of a single rogue trader; however, a more detailed analysis reveals that the organizational culture contributed to the catastrophe by permitting a persistent failure to balance the accounts (Reason 1998). Now may be the time to consider traffic safety not as an individual issue but rather an organizational and societal one.

Considered independently, every crash represents mishaps at the scale of the individual, but the annual toll of crashes may best be considered a societal mishap. Reason (1998) examined the consequence of considering mishaps as individual or organizational failures. Important differences include the influence of context and the visibility of safety boundaries. Considered as individual failings, mishaps reflect the behavior of people responding to immediately visible indicators of safety boundaries with little influence from the organizational context. According to this perspective, people are assumed to be in close contact with hazards, and failures occur because of inappropriate choices and cognitive limits. Applying this to driving, individual drivers have a direct view of weather conditions and emerging roadway hazards, and crashes occur because drivers are reckless and error prone.

A more productive approach may be to consider crashes from an organizational perspective. According to this view, determining the cause of a crash requires a broad consideration of its context and an understanding that safety boundaries may not be immediately visible to the individual. Reason notes that with industrial processes the layers of defense can sometimes allow individuals to inadvertently approach and cross critical safety boundaries without feedback to guide safer behavior, encouraging a culture of noncompliance. We can draw parallels to driving, where the multiple layers of defense and delay in feedback diffuse responsibility, propagate unsafe practices, and increase the risks that society deems acceptable. Despite the parallel with industrial safety, relatively little effort has been made to apply the insights of risk management research to the driving domain.

Driving culture has only recently surfaced as a focus of scholarly inquiry within the social sciences (Featherstone 2004; Miller 2001; Sheller and Urry 2006). Two distinct but overlapping approaches have emerged. The first focuses on the car as a form of material culture, asking the deceptively simple question “what is a car?” as its analytical starting point (Miller 2001). Miller (2001) suggests that we shift our understanding of the car from utilitarian accounts of its use value, or doomsday accounts of its destructive capabilities, to humanist accounts that consider the car as necessarily entangled with our sense of being human. Work within this approach examines the everyday consumption of the car across cultures (Young 2001), and the role cars play in constructing cultural identity. It looks at, for example, youth culture defined through car consumption (Carrabine and Longhurst 2002) and the negotiation of gender identity and politics through everyday engagements with cars and daily mobility (R. Law 1999; Stotz 2001).

The second approach emerges out of what Sheller and Urry (2006) call the "new mobilities paradigm." This perspective advocates an emphasis on the fluidity, temporality, and motion involved in social exchanges, as well as the activities that occur while (in our case) drivers are on the move. It is concerned not with the destination but rather with the trip itself. Sheller and Urry (2006) suggest that the absence of a consideration of travel within the social sciences is due to it being perceived as a "black box, a neutral set of technologies and processes predominantly permitting forms of economic, social, and political life that are seen as explicable in terms of other, more causally powerful processes." They attribute this to a sedentarist approach in the social sciences that favors stability and place while disregarding distance, change, and mobility. They and others counter this with a focus on automobility, with the double meaning of "auto" hinting at the hybrid character of the linked car and driver, simultaneously intertwining humans, machines, infrastructure, and "cultures of mobility." Research within the new mobilities paradigm examines the embodiment of different forms of travel, "seeing them in part as forms of material and sociable dwelling-in-motion, places of and for various activities" (Sheller and Urry 2006).

Although these approaches have begun to address the culture gap in driving research, relatively few have addressed driving and safety (for exceptions, see Beckmann 2004; Featherstone 2004; Lupton 1999). They do, however, provide insights into how to approach driving culture. In the next section we take a step back to critically reflect on the concept of culture. Taking our cue from the work cited above, we then think through the implications of a theorized culture on driving and traffic safety.

Towards a theorized culture

Definitions of culture are plentiful and varied[1], in large part due to the expansive reach of the "cultural turn" across the social sciences and humanities in the past two decades. A common definition of culture is that it consists of the beliefs, values, norms, and things people use, which guide their social interactions in everyday life. Using this definition to understand driving culture, we can, for example, document what people believe is acceptable driving behavior, or the degree to which people believe they can mitigate risk through the vehicles they drive. What is missing, however, is an account of the processes by which society creates, reproduces, and justifies certain values and beliefs while suppressing others. Who defines what is acceptable driving behavior, and with what effect? What constitutes risk for different driving populations, and how do factors such as social status influence how risks are perceived and addressed?

Although the rather insular debate over the meaning of culture may seem esoteric, it has serious implications for the way in which we approach the study of and interventions into driving culture. At the most fundamental level, a consideration of culture as a *structure* or as a *process* points to a tension between an approach that accepts culture as an "unproblematic category that can be used to explain people's behavior" (Jackson 1989) and one that seeks to understand culture's mutability. As Mitchell (2004) notes, "culture can never be an explanation: it is what must be explained." What follows are five points inspired by Mitchell that suggest how we should tackle "explaining" culture.

1 Mitchell (2004, 156) notes four typical definitions: "ways of life," "maps of meaning," "systems of signification," or "habits and norms."

1. Culture is never naturally given. The push to define what culture is assumes that there is a natural and necessary link between a meaning and the thing (e.g., object, activity, idea) to which it is attached. Essentialist positions such as this have the effect of fixing culture, denying its historical and geographical context because it presupposes the meaning of culture prior to its articulation through everyday practice. Taussig (2004, 308), quoting Strathern (1993), states that culture "lies in the manner in which connections are made [between ideas], and thus in the range of contexts through which people collect their thoughts." Culture, then, is context dependent, not static or predetermined. This implies two points relevant to traffic safety culture. First, by acknowledging culture as a dynamic process of interaction reproducing meaning and patterns of behavior, not a static entity containing them, we also acknowledge the agency of traffic safety stakeholders to affect social change. Second, taking seriously the notion that culture is context dependent means that attempts to change culture must consider the places and networks of relations in which people are engaged that both create opportunities and limit options for how people make sense of the world.

2. Culture is never singular. Many discussions of culture mask the diversity and fragmented character of social life by suggesting that a group has a coherent or unified identity or perspective. While there can be a generic quality to culture, it is experienced, and therefore rearticulated, in varying contexts (see above). At the most intimate scale, an individual driver could embody conflicting emotional connections to her car, experiencing it as her "territory" where she seeks refuge from her daily responsibilities, only in a later context to feel oppressed by its part in fulfilling the domestic obligations her role as mother requires (Sheller 2004). Here, safety may represent the burden of family, and escape, therefore, may translate into unsafe driving practices (Garvey 2001); such nuances would be lost if we approached family carpooling as universally experienced and understood. This suggests that efforts to change driving culture must recognize its plurality and account for the multiplicity of driving practices and populations that constitute specific, localized roadway cultures.

3. Culture is never neutral. Contemporary perspectives suggest that culture is constructed and stabilized within intellectual, political, and economic arenas, which reflect and reproduce dominant beliefs and values (Haraway 1991; Latour 1993). This suggests that systems of meanings surface as effects of contestations among and between micro (individual) and macro (institutional) scales of interaction. For example, while exceeding the speed limit is a violation of traffic safety regulations, the consequences of doing so are negotiated between enforcement officials and drivers. Strict enforcement changes how drivers behave, even when law enforcement is not present. Lax enforcement has the opposite effect, creating a driving culture that accepts the additional risks associated with increased speed for the personal benefits associated with faster travel. This suggests that what we recognize as a culture of complacency regarding driving is actually the product of negotiations between different actors with varying interests. As such, efforts to promote a shift in driving culture must move beyond a singular focus on the driving public to include the multiple actors (e.g., law enforcement, policy makers, educators, engineers) involved in negotiating our dominant systems of meaning vis-à-vis driving. Any approach to establish traffic safety culture must reinforce the shared responsibility among individuals and institutions for promoting and practicing safe driving.

4. Culture is always an effect of power. Closely related to the previous point, because culture is reproduced through social relations, it is necessarily imbued with power. Power here is not sovereign power, but rather decentered, relational power, following from Michel Foucault's extensive work on the subject. Examining the social processes at play in the stabilization of

culture provides great insight into the way in which power shapes what emerges as "culture." The transformation of public perception and social practice brought on by the success of the organization Mothers Against Drunk Driving (MADD) after its inception in 1980 illustrates this point. In its first four years of activism, then-President Ronald Reagan announced a Presidential Commission on Drunk Driving, federal highway funds were set aside for state-level anti-drunk driving initiatives, state-level anti-drunk driving bills were enacted, and the Federal 21 Minimum Drinking Age Law was passed. MADD's early achievements represent a success in promoting driving safety culture through grassroots activism. Such successes demonstrate that while the driving public is often characterized as acquiescent, they are capable of producing radical cultural change. An important point of leverage for national organizations committed to traffic safety is collaborations with community-based initiatives that promote culture's change through local activism.

5. Culture is best modified through changes in social practice. Risk management literature suggests that the most productive points of leverage are material in nature, advocating a focus on modifying structures, policies, and controls over attempting to change beliefs, values, and attitudes (Reason 1998). The move many states are making toward graduated licensure for new teen drivers bears this out. While drivers' education is instructive in communicating traffic laws that govern driving, graduated licensure has shown promise in reducing teen driver crash rates through restricting when, how, and with whom teens drive (Insurance Institute for Highway Safety 2006). For the traffic safety community, interventions must value praxis-oriented solutions ranging, for example, from implementing a compulsory "How's My Driving?" program for all motor vehicles (Strahilevitz 2006) to reallocating enforcement funds to increase police presence on roadways. Such approaches can be powerful. Commercial fleets that have placed "How's My Driving?" placards on trucks have seen 20–53% reductions in crash rates. The following section builds on these insights to identify ways in which driving culture might be altered to promote traffic safety.

Theory-based interventions informing a culture of safe driving

In this section we present snapshots of four approaches to culture's construction and stabilization that we believe are useful to understand driving as a complex and multidimensional cultural practice. These approaches are multidisciplinary in nature. They were developed in conversations between fields including geography, cultural studies, science studies (broadly drawn), organizational studies, and risk management. Each is fundamentally relational, advocating an approach that understands culture as a process, generated through relationships between drivers, vehicles, roadways, and the institutions involved in driving. They also share a commitment to broadening what traditionally falls under the purview of culture, expanding our understanding of how culture is generated. In each section we briefly describe the approach, provide concrete examples to illustrate how it relates to promoting traffic safety culture, and identify points of leverage made possible through its application.

A place-based approach

Motor vehicle travel is the primary means of transportation in the U.S., yet as Sheller and Urry (2006) note, little attention is paid to the cultural forms engendered through the "dwelling-in-motion" that characterizes the car trip. In cars, drivers interact with passengers, talk on wireless phones, read, listen to music, eat and drink, groom themselves, even watch movies and use wireless remote-access Internet service (The Gallup Organization 2003). While driving, drivers communicate with each other using turn signals, horns, hand gestures, etc. They also build and strengthen associations with their driving environments through repeated patterns of activity and behavior. Cars, then, become more than a form of transportation, and the roadway more than just a surface upon which we drive. They come to constitute part of life's geography, or the ways in which social practices make spaces, such as the filling station, the Interstate, the rest stop (Normark 2006), and vehicles themselves (Laurier 2004), into unique places imbued with meaning.

Perhaps because of the familiarity of car travel and its instrumental role in our daily lives, crashes are accepted as unavoidable consequences of the convenience of car travel. At the societal scale, crashes are seen as aberrations, or worse, as banal events worth little public attention beyond voyeuristic curiosity (Featherstone 2004). Yet they are not experienced as such by those most closely affected by crashes: drivers, passengers, and pedestrians killed or injured in a crash, friends and family mourning the loss of loved ones, and communities grappling with a crash's aftermath. As with car travel, responses to crashes are emplaced or imprinted on local landscapes. Impromptu roadside memorials or sobriety checkpoints, for example, produce for many a momentary slip in how they perceive the spaces in which they live and the things, such as cars, that they use and embody on a daily basis.

These examples suggest that place plays a role in how we experience and shape traffic safety culture. Following from Massey (1994), we define place as a constellation of socio-spatial relations that intersect at a particular time and place. State-level responses to the 1998 Transportation Equity Act for the 21st Century (TEA-21) help unpack this definition. As part of the authorization of Federal surface transportation programs for highways and highway safety, the law required states to adopt acceptable open-container laws in order to receive their federal highway construction funding. While many states passed open-container laws, several states refused to adopt the provision. In testimony before the Montanan legislature in 2003, then-Governor Judy Martz characterized her constituents' opposition to the open-container bill as entrenched in a place-based identity: "there is a myth in Montana that drinking and driving is part of being a Montanan" (Martz 2003). Here "being a Montanan" describes the localized, "particular" response of resistance to government intervention that is ingrained in Montana's autobiography, or the stories Montanans tell themselves about who they are in relationship to their sense of place. The invocation of place extends beyond their identification as Montanans to also include the place-making that occurs in their vehicles and on the roadway, as these are the everyday sites in which such forms of resistance are enacted.

A place-based approach provides a framework within which we can examine vehicles and roadways as "places-in-the-making," or spaces where meanings are continuously redefined through repeated engagement. Considering cars as "places" for the hanging-out activities of teenagers, for example, expands the work of others who have shown how teens' identities are

shaped through their use of cars. Dunkley (2004) documents the role male teens' emerging masculinity plays in the social geographies of rural youth who drive across the Canadian border in order to drink in bars. Extending her thesis to include the socio-spatial relations unfolding in teens' cars would provide another angle from which we can analyze the behaviors that contribute to or challenge sensation-seeking and risk-tolerance among teens. Carrabine and Longhurst (2002) examine how the ability to drive, and car consumption itself, affords participation in extended networks of sociability. A place-based approach that considers the social practices occurring in cars could provide stakeholders with a richer understanding of the conflicting pressures teens must negotiate (e.g., to socially "fit-in" or to drive safely) while driving and how that affects their behavior and performance.

From these examples we see that places are defined by and in turn define people's identities, and that cars and driving play an important role in how people experience the places through which they travel. This suggests our first point of leverage: that we approach traffic safety culture by addressing the way driving cultures are reproduced through practices that take (and conversely, make) "place" (Jackson 1989). The specificity of place provides insight into the influence on driving behavior of the micro-cultures of the car and the roadways on which drivers travel on a daily basis. For example, ethnographic field methods could be used to document how teens use their cars, what activities occur in their cars, and what car travel means in relationship to social status and identity construction. Such analyses could inform culture-based interventions to risky driving behavior by, for example, implementing restrictions that limit activities that pose the greatest risk for teens while driving (e.g., driving at night or with teenaged passengers). A place-based approach also can account for the unique identities certain roadways acquire. Broadly drawn, urban roadways have a different set of norms related to communication and acceptable risk-taking strategies than do rural roadways. Such differences suggest that uniform initiatives that disregard the specificity of place may not be relevant to particular segments of the driving public.

Cyborg interventions

Advances in vehicle design and technologies have brought to the American consumer increasingly "smarter" vehicles. Such vehicles provide greater protection to occupants during crashes, detect critical driving situations, and adapt to these situation without driver input (Lee and Kantowitz 1997; Walker, Stanton, and Young 2001). One element of smart vehicle technology is its ability to "learn" the driver's preferences and behaviors, adapting its function to the driver and driving environment. Sophisticated in-vehicle safety systems exemplify this trend, featuring driver-state monitoring systems able to determine the driver's workload and distraction level and temporarily disable carry-on technologies when distraction presents too high of a risk (Donmez, Boyle, Lee, and McGehee in press). Such enhanced safety systems more readily reveal the blurred distinctions between the driver, car, and roadway that have always existed but have rarely been acknowledged. This is a far cry from early approaches to driving and traffic safety, which assumed that cars are inert and passive and that driving is something the human does to the car and the road (Dant 2004). How "car" and "driver" have been separated reflects western philosophical traditions that uphold the separation of mind from matter, a separation that does not have ontological grounding. What happens—epistemologically, ontologically—when we reject the distinction between the driver and the car and instead attempt to understand the qualities of an emergent car-driver hybrid?

The metaphor of the cyborg (Haraway 1991) sheds light on the influence of technology on culture, and is particularly useful in our attempt to understand the car-driver hybrid as an effect of and agent in the construction and stabilization of driving culture. Part human, part machine, the cyborg recognizes a social reality that has emerged out of the increased proliferation of technology in our daily lives. The cyborg metaphor has the potential to change what influences culture precisely because of how it reconceptualizes what counts as agents in culture's construction. Much of Haraway's *Cyborg Manifesto* (1991) reexamines commonly accepted boundaries: organisms and machines, nature and culture, and physical and non-physical entities. On close examination, Haraway demonstrates that all of these boundaries are porous. Cyborgs embody transgressed boundaries, constituting a complex set of partials—partial knowledges, partial experiences, and partial viewpoints.

Reconceptualizing driving as a relational activity performed by a car-driver assemblage provides another lens through which we can understand driving behavior as rooted in culture. In this framework, driving is the combined effect of couplings between people and machines. Using a cyborg approach, Lupton (1999) analyzes the phenomenon of road rage, going beyond systemic explanations (e.g., roads are too congested) to explore how "the embodied ontology of the car-driver relationship is constructed, negotiated and experienced." She notes that cyborg subjectivities are not only about one individual's interaction with his car, but also about how that cyborg coupling interacts with other cyborgs on the roadway. In her analysis of interviews with drivers, Lupton notes the dehumanizing tendencies that accompany the emerging cyborg subjectivity. The pseudo-private space afforded by the "metal cocoon" of the car permits some drivers to act against social order, with the effect of justifying violent and dangerous driving by denying the humanity of other roadway occupants. In turn, the car enables the driver to become a "monster" whose emotional reactions to the driving environment are exacerbated by the increased physical force of the car-driver coupling.

Lupton's reimagining of road rage from a cyborg perspective does not add nonhumans to the mix, but rather it accounts for the shared experience, the commingling that is integral to understanding the complex dynamics of driving culture. It recognizes that driving is an embodied experience, and, thus, that the emergent material and discursive qualities of the car-driver are unique to its coupling, not solely the experience of the driver independent from her car. This suggests our second point of leverage: by accepting the agency of the car-driver hybrid, we can influence driving behavior in new ways that can change driving culture and promote greater safety. For example, speed selection was once governed by the driver. Emerging technologies place increasing agency in the car-driver hybrid, such that intelligent speed adaptation and adaptive cruise control make speed choice very much the product of a cyborg rather than a person. Understanding how to influence this evolving agency to achieve even modest reductions in speeding could save many lives.

To date, vehicle technology has been developed without regard for how it might influence driving culture, but this does not have to be the case. Possible interventions include equipping vehicles with technology specifically designed to promote a safety-oriented driving culture. Vehicles, for example, could record instances of risky behavior that force other drivers to compensate. A summary of such instances could provide consistent feedback regarding the risks that drivers take but often fail to recognize. Such information, summarized across a community,

could become a point of pride for the individual and the community, eventually promoting a safety-oriented driving culture.

A network-based approach

Vehicles rely on more than just the driver's inputs for safe mobility to occur. While the cyborg metaphor implies an inward-looking view that accounts for the permeable boundaries between entities, dissecting the operation of a car exposes the vast networks that coalesce to produce the driving event. Vehicle operation depends on the electromechanical network of the vehicle and the neurophysiological network of the driver. The driver must have some degree of driver education and training to learn how to drive. She also must have the financial resources needed to operate and properly maintain her vehicle according to manufacturer guidelines and government regulations. At a macro level, extended networks of vehicle manufacturers, petroleum producers and transporters, road crews, and regulatory and enforcement organizations must be adequately funded, safeguarded, and managed. And future design requirements and driving regulations depend in part on the work of accident investigators and reconstructionists, who generate accident reports that transform the car-driver from a mobile assemblage to data (Dant 2004).

Actor-network theory (ANT) (Latour 1987; J. Law 1994) provides a theoretical and methodological resource for understanding how complex networks of people, vehicles, organizations, and infrastructure influence driving culture. Like cyborg perspectives, ANT forces a rethinking of the relationship between people and things, extending agency to vehicles and the built environment as a way to account for the influence inanimate objects have on the interactions among people and between people and things. The example above documents the heterogeneous associations between human and nonhuman entities, including drivers, cars, money, accident reports, engineers, and so on. Actor-network theory proposes that these entities, called *actants*, take and keep their material and discursive shape through relations with others in their network (Murdoch 1997; Whatmore 2002). The emphasis of ANT is less on explaining why something occurs in favor of tracing how networks emerge and are maintained and justified, or abandoned and dissolved.

Barnes (2001) highlights several insights developed under the rubric of ANT. First, networks are not static entities but are always in the process of becoming. Their dynamism does not, however, mean that they are not durable. To the extent that actors are committed to the network's linkages, the network maintains stability. This implies that networks also are modifiable and potentially fragile, with the ever-present possibility of breaking down. When one network disintegrates, the web holding the actors in place reconfigures, changing the relations, and therefore the meaning, of the actors. Simply stated, according to ANT, context matters in discerning what a thing, like a vehicle, means. Second, as a consequence, knowledge and "truths" that emerge are specific to a network; they are not universal. Third, following from this, actors possess no essential meaning. Rather, meaning is continuously generated within the network of relations of which an actor is part. An intact car "is" something wholly different than a car in the scrap yard or the car as it is represented in an accident report, yet each instance shares the same moniker (Beckmann 2004). Fourth, actors are enrolled into a network through a process called translation, which, much like its use in linguistics, involves creating convergences between actors by relating things that were previously different (Gherardi and Nicolini 2000).

Actor-network theory has held particular sway within risk management and public health literatures, especially in the collective effort to better understand how knowledge about safety is translated between actors. Gherardi and Nicolini (2000) use ANT to disrupt the presumed stability of "safety knowledge" within the construction industry. They document how safety is performed through often divergent daily practices, such as a site foreman avoiding unwanted attention from inspectors by placing scaffolding only on a new construction's exposed side. The foreman's performance of safety circuitously demonstrates that he has developed cultural competence regarding "official" safety knowledge while at the same time subverting it. The interplay between site foremen and safety inspectors illustrates how competing perspectives on safety coexist, not in a consensus or compromise, but in constant negotiation.

Lloyd and Roen (2002) document a similar fluidity of knowledge between fire-safety experts and their interactions with households participating in fire-safety programs. The authors document variations in firefighters' assessment, advice, and training as they evaluate residents' fire-safety preparedness, including testing fire alarms and discussing escape routes. Firefighters noted that the guidelines they are required to follow seem idealistic when actually applied to residents' homes, especially for households with limited financial resources. As a result, instead of offering uniform feedback, firefighters provided assessments that they deemed appropriate given the household's specific set of circumstances. Lloyd and Roen found that for fire-safety knowledge to work (i.e., reduce injuries and fatalities), it has to be made meaningful for those whose responsibility it is to enact it. Safety knowledge is not something that can be universally applied, but rather it is continually performed and, therefore, transformed through adaptation in the various contexts in which it is put to use.

As demonstrated through these examples, safety knowledge is not delivered and accepted or rejected, but rather generated through complex social interactions between networks of actors. In driving, a safety culture emerges through a similarly complex network. Revealing the vast networks of actors supporting what we recognize as U.S. driving culture thus reverses the tendency to ascribe behavior to overly simple linear causation. This suggests our third point of leverage: what emerges as "driving culture" is necessarily situated in networks of ongoing social practice. As a concrete example, just as speed choice depends on the cyborg combination of the driver and vehicle, it also depends on the speed of the traffic that surrounds them. Actor-network theory provides a methodology for tracing how specific behaviors like speed choice and cultural concepts like "safety" are valued or devalued and propagated through everyday driving practices, a point we believe is critical in attempts to construct and promote a traffic safety culture. A network approach provides a critical lens through which to discern how complacency, for example, in U.S. driving culture has been held in place among a variety of actants. It also reveals what practices already exist that promote traffic safety culture but have yet to comprise a robust network.

One of the insights of ANT is that the more robust the network, the more influential its hold on society. To affect large-scale cultural change, individuals and organizations at the local, state, and national scales (e.g., Students Against Destructive Decisions, Mothers Against Drunk Driving, the National Highway Traffic Safety Administration, AAA Foundation, and the Insurance Institute for Highway Safety) need to work together to enroll actors into a traffic safety network. This can be achieved through activism that translates "traffic safety" in such a way as to make it relevant to inhabitants of different driving cultures. Knowledge and social norms then circulate

through this network according to the topology of the network connections, which may differ dramatically. Specifically, social network analyses could reveal particularly influential members of the network. Recent studies have shown that relatively few nodes of a network often have a disproportionate influence on the whole (Borgatti and Foster 2003; Watts 2004; Watts, Dodds, and Newman 2002).

A multilevel control approach to enhancing driving safety

The network of interactions that contribute to driving culture described above often will adapt and evolve in a manner that promotes driving safety. However, this is not always the case. In driving, as in other domains, the network of actors involved can emerge in a configuration contrary to safety (Reason 1998). To guide adaptation that favors safety requires a degree of control. Figure 1 shows a framework of risk management developed for complex sociotechnical systems that places driving in a broader, multilevel control process (Rasmussen 1997). The framework identifies specific actors and relationships that define the network associated with driving safety. This structure highlights distances in time and association between drivers at the bottom of the diagram and the government at the top.

An important challenge highlighted by Figure 1 is that of control in the face of the diverse range of environmental stressors shown on the right of the figure. These stressors, and the associated time constants of the various processes, present a substantial challenge to controlling driving safety. For example, the rate of information technology development is quite rapid, with major innovations occurring on a timescale of months. The pace of regulatory intervention, however, has evolved to address the relatively slow pace of the traditional automotive industry. In addition, the information flow from traffic incidents and accidents upwards to those making regulatory decisions is imperfect and delayed. The safety consequences of new information technology illustrate this problem. A distracting product might be used for years and kill thousands of people before the loop is closed and regulatory control is enacted. One approach to this challenge uses emerging in-vehicle technology to provide more sensitive and timely measures of driving safety than those afforded by the national crash databases. The output of collision warning systems, driver behavior, and in-vehicle device interactions could be monitored, combined, and aggregated at the individual, community, and national levels to provide a clearer signal for how behavior at all levels influences safety.

Another important challenge in addressing driving safety issues is the heterogeneity of the network influencing driver behavior. The left side of Figure 1 shows the range of disciplines that may be involved in enacting control. Because driving safety emerges out of the network of interconnections that span these levels of controls, it cannot be enacted as if the levels were independent. As an example, the engineering expertise needed to develop collision warning systems is not sufficient to ensure that such systems actually enhance driving safety (Deering and Viano 1998). Successful control depends on expertise spanning all levels in Figure 1. At the highest level, driving safety depends on political decisions and governmental priorities. Linking the effects of political decisions to the features of in-vehicle technology presents a substantial

challenge. This suggests our fourth point of leverage: promoting a safety-oriented driving culture requires multidisciplinary expertise to understand how the effects of controls at various levels propagate through the network of factors affecting driving safety.

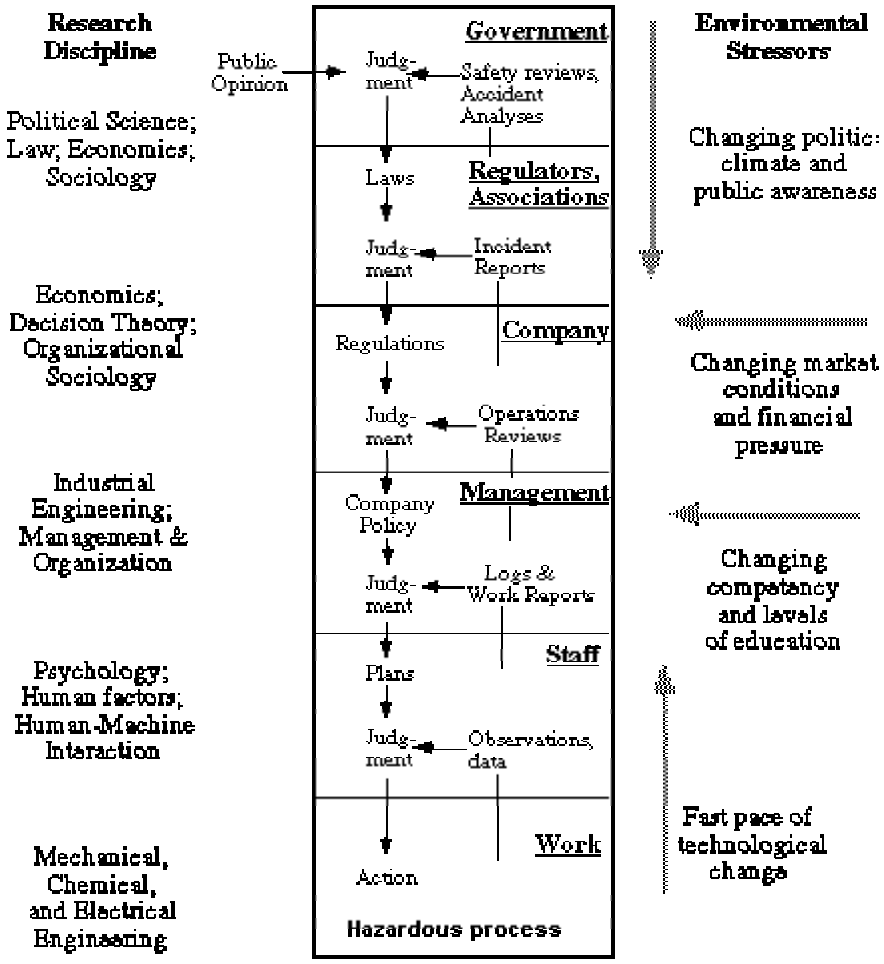

Figure 1. Driving safety as a societal risk-management challenge (Rasmussen 1997)

Conclusions and recommendations

The laws of physics limit how much increasing vehicle crashworthiness can enhance safety. Likewise, vehicle warning systems can compensate for the cognitive and perceptual constraints that affect driver performance, but they cannot override a driver's attitudes, goals, and priorities. Driver behavior, then, may ultimately have the most influence on traffic safety. Culture provides the subtext to driver behavior by shaping the beliefs, values, and ideas people bring to the driver's seat each time they get behind the wheel. On a larger scale, cultural forces also give form to "driving safety" by defining social norms regarding acceptable numbers of driving-related deaths and the amount of resources that should be devoted to driving safety research,

regulation, and enforcement. As a consequence, changing driving culture may be the most effective means of enhancing driving safety. Unfortunately, transforming culture presents a substantial challenge, in no small part because many believe that culture cannot change.

In this chapter, we suggest that how we think about culture affects how we might promote driving safety. We make the case for re-conceptualizing culture as dynamic and flexible, and we offer four approaches to culture that we believe capture important aspects of the complex interplay between people, vehicles, roadways, driving regulations, and stakeholders involved in defining and promoting traffic safety. Although these approaches stand alone, they share several goals. First, each takes the stance that culture is a process, not a taken-for-granted category that can be uncritically deployed to explain human behavior. Second, each expands what falls under the rubric of culture, with the effect of broadening our understanding of how culture is generated. Third, each advocates a materialist approach to culture's construction and stabilization by addressing where and how people live, their embodied experiences of driving, and the social practices that transform their engagement with things, institutions, and ideas. The final approach suggests that we, as stakeholders in the traffic safety community, have an important role in changing driving culture, but that crafting effective safety policies in a time frame that is appropriate for the rapidly changing world of technology requires a multidisciplinary, interorganizational approach not yet embraced by the various actors in the safety network. These insights constitute points of leverage that are available to promote a safety-oriented driving culture.

Many research plans and intervention strategies could be pursued using these suggested approaches, as evidenced in the potential applications peppered throughout the chapter. Although these approaches provide independent contributions to our analysis of driving culture, the elements that they share imply a certain power in their convergence. With this in mind, we propose a participatory action research program designed to promote traffic safety culture to a broad range of communities across the U.S. Participatory action research involves shared participation and ownership in research projects among a community of coresearchers, with the focus of research defined by analyses of social problems at the local level. It also typically involves community action to address issues raised through the research process (Kemmis and McTaggart 2005). Because it is action oriented, it prioritizes transformations of social practice over attempts to change culture through ideological shifts alone. However, many who participate as coresearchers experience consciousness raising—about their position vis-à-vis the institutions that shape their lives, as well as their agency to affect change—through the process of defining and addressing social problems. Finally, for members of the traffic safety community, it reframes social research as a powerful form of public engagement (Gibson-Graham 1994).

The program's goal would be to facilitate collaborations between researchers and regional and national organizations with select local communities in order to identify and address local issues regarding driving and traffic safety. Together, they would develop an action plan to address local driving issues and participate in its implementation. Coresearchers would then evaluate their community-based effort by developing criteria and a process to assess its success. The program would be user driven and place specific in order to ensure relevancy for and cooperation with local driving populations. At the same time that "knowing subjects" (Gibson-Graham 1994) participate in shaping their local driving cultures, site-specific data will be collected for comparative case studies analyzing (1) traffic violations and accidents reports, (2) driving practices across populations, (3) organizational effectiveness among state, city, and private institutions involved in shaping local driving practices, (4) the range of issues identified, (5) the types of

action plans developed and implemented, and their effect on driving practices, and (6) the ways in which plans were evaluated and the results of evaluations. The comparative case studies provide an assessment of the project as a whole, as well as identifying "best practices" developed by drivers for drivers. Because local projects are place specific, their application across a range of driving environments will not be seamless. Yet they will shed light on the complexity of driving culture in the U.S. and how people in particular places balance the risks and benefits of car travel. When identified, those expressions of driving culture that transect driving populations across the U.S. can be incorporated into national campaigns designed to augment local responses.

References

Barnes, T. J. 2001. "In the beginning was economic geography"—a science studies approach to disciplinary history. *Progress in Human Geography* 25 (4): 521–44.

Beckmann, J. 2004. Mobility and safety. *Theory, Culture & Society* 21 (4/5): 81–100.

Blockey, P. N., and L. R. Hartley. 1995. Aberrant driving behavior: Errors and violations. *Ergonomics* 38 (9): 1759–71.

Borgatti, S. P., and P. C. Foster. 2003. The network paradigm in organizational research: A review and typology. *Journal of Management* 29 (6): 991–1013.

Carrabine, E., and B. Longhurst. 2002. Consuming the car: Anticipation, use and meaning in contemporary youth culture. *The Sociological Review* 50 (2): 181–96.

Dant, T. 2004. The driver-car. *Theory, Culture & Society* 21 (4/5): 61–79.

Deering, R. K., and D. C. Viano. 1998. Critical success factors for crash avoidance countermeasure implementation. In R. K. Jurgen, ed. *Object detection, collision warning and avoidance systems*. Warrendale, PA: Society of Automotive Engineers, Inc., 173–8.

Donmez, B., L. Boyle, J. D. Lee, and D. V. McGehee in press. Driver acceptance of distraction mitigation strategies: Focus group and simulator studies. *Transportation Research Record*.

Dunkley, C. M. 2004. Risky geographies: Teens, gender, and rural landscape in North America. *Gender, Place and Culture* 11 (4): 559–79.

Evans, L. 1991. *Traffic safety and the driver.* New York: Van Nostrand Reinhold.

———. 2004. *Traffic safety.* Bloomfield Hills, Michigan: Science Serving Society.

Featherstone, M. 2004. Automobilities: An introduction. *Theory, Culture & Society* 21 (4/5): 1–24.

Garvey, P. 2001. Driving, drinking and daring in Norway. In D. Miller, ed. *Car Cultures*. New York: Berg, 133–52.

Gherardi, S., and D. Nicolini. 2000. To transfer is to transform: The circulation of safety knowledge. *Organization Science* 7 (2): 329–48.

Gibson-Graham, J. K. 1994. ,"Stuffed if I know!": Reflections on post-modern feminist social research. *Gender, Place & Culture* 1 (2): 205–25.

Haraway, D. J. 1991. *Simians, cyborgs, and women: The reinvention of nature*. New York: Routledge.

Insurance Institute for Highway Safety. 2006. Teen drivers' crash rates go down significantly under provisions of California's graduated licensing law, Retrieved November 15, 2006 from: http://www.iihs.org/news/rss/pr083106.html.

Jackson, P. 1989. *Maps of meaning*. New York: Routledge.

Kemmis, S., and R. McTaggart. 2005. Participatory action research: Communicative action and the public sphere. In N. K. Denzin and Y. S. Lincoln, eds. *The sage handbook of qualitative research methods* (Third Edition). Thousand Oaks: Sage Publications, 559–603.

Latour, B. 1987. *Science in action: How to follow scientists and engineers through society.* Cambridge: Harvard University Press.

———. 1993. *We have never been modern*. Cambridge, MA: Harvard University Press.

Laurier, E. 2004. Doing office work on the motorway. *Theory, Culture & Society* 21 (4/5): 261–77.

Law, J. 1994. *Organizing modernity.* Oxford: Blackwell Publishers.

Law, R. 1999. Beyond "women and transport": Towards new geographies of gender and daily mobility. *Progress in Human Geography* 23 (4): 567–88.

Lee, J. D. 2006. Driving safety. In R. S. Nickerson, ed. *Review of human factors*. Santa Monica, CA: Human Factors and Ergonomics Society.

Lee, J. D., and B. H. Kantowitz. 1997. Perceptual and cognitive aspects of intelligent transportation systems. In W. Barfield and T. Dingus, eds. *Human factors in intelligent transportation systems*. Mahwah, NJ: Lawrence Erlbaum Associates, 31–54.

Lloyd, M., and K. Roen. 2002. "When you smell smoke…": "risk factors" and fire safety in action. *Health, Risk & Society* 4 (2): 139–53.

Lupton, D. 1999. Monsters in metal cocoons: "Road rage" and cyborg bodies. *Body & Society* 5 (1): 57–72.

Martz, J. 2003. *Open container testimony (SB 39)*, 108th Cong., 1st Sess. (2003) (testimony of Governor Judy Martz). Retrieved 11/27/2006 from http://mt.gov/gov2/css/speeches.asp?ID=56.

Massey, D. 1994. *Space, place, and gender.* Minneapolis: University of Minnesota Press.

Miller, D., ed. 2001. *Car cultures*. New York: Berg.

Mitchell, D. C. 2004. Cultural geography at the millennium: A call to (intellectual) arms. *Journal of Cultural Geography* 22 (1): 155–7.

Murdoch, J. 1997. Towards a geography of heterogeneous associations. *Progress in Human Geography* 21 (3): 321–37.

Normark, D. 2006. Tending to mobility: Intensities of staying at the petrol station. *Environment and Planning A* 38:241–52.

Parker, D., A. S. R. Manstead, S. G. Stradling, and J. T. Reason. 1992. Determinants of intention to commit driving violations. *Accident Analysis and Prevention* 24 (2): 117–31.

Parker, D., J. T. Reason, A. S. R. Manstead, and S. G. Stradling. 1995. Driving errors, driving violations and accident involvement. *Ergonomics* 38 (5): 1036–48.

Rasmussen, J. 1997. Risk management in a dynamic society: A modeling problem. *Safety Science* 27 (2–3): 183–213.

Reason, J. 1998. Achieving a safe culture: Theory and practice. *Work and Stress* 12 (3): 293–306.

Reason, J., A. Manstead, S. Stradling, J. Baxter, and K. Campbell. 1990. Errors and violations on the roads—a real distinction. *Ergonomics* 33 (10–11): 1315–32.

Sheller, M. 2004. Automotive emotions: Feeling the car. *Theory, Culture & Society* 21 (4/5): 221–42.

Sheller, M., and J. Urry. 2006. The new mobilities paradigm. *Environment and Planning A* 38, 207–26.

Stotz, G. 2001. The colonized vehicle. In D. Miller, ed. *Car cultures*. New York: Berg, 223–44.

Strahilevitz, L. J. 2006. "How's my driving?" for everyone (and everything?). *New York University Law Review* 81 (5): 1699–765.

Taussig, K. S. 2004. Bovine abominations: Genetic culture and politics in the Netherlands. *Cultural Anthropology* 19 (3): 305–36.

The Gallup Organization. 2003. *Volume I: Findings, national survey of distracted and drowsy driving attitudes and behaviors: 2002*, Retrieved 11/16/2006 from: http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/survey-distractive03/index.htm.

Walker, G. H., N. A. Stanton, and M. S. Young. 2001. Where is computing driving cars? *International Journal of Human-Computer Interaction* 13 (2): 203–29.

Watts, D. J. 2004. The "new" science of networks. *Annual Review of Sociology* 30:243–70.

Watts, D. J., P. S. Dodds, and M. E. J. Newman. 2002. Identity and search in social networks. *Science* 296 (5571): 1302–5.

Whatmore, S. 2002. *Hybrid geographies: Natures cultures spaces*. Thousand Oaks: Sage Publications.

Young, D. 2001. The life and death of cars: Private vehicles on the Pitjanjatjara lands, South Australia. In D. Miller, ed. *Car cultures*. New York: Berg, 35–58.

Biographical statements

Jane Moeckli is a staff research assistant at the National Advanced Driving Simulator (NADS). She is nearing completion of her Ph.D. in Geography at The University of Iowa, where she has specialized in cultural geography, specifically focusing on ephemeral space and on the role of "environmental responsibility" as an organizing principle within organizational cultures. Her interests in responsibility and in ephemeral spatial events inform her research directive at the NADS to better understand safety culture generally and the culture of the road and driving specifically. She has also participated in several outreach events at the simulator, most notably

traveling to area high schools with the novice-driver research team at the NADS in order to talk frankly with teens about safe driving.

John D. Lee is a professor of Industrial Engineering at The University of Iowa and has appointments in the Department of Neurology, the Public Policy Center, the Injury Prevention Research Center, and the Center for Computer-Aided Design. He has a background in engineering and psychology, with a Ph.D. in mechanical engineering and an M.S. degree in industrial engineering from the University of Illinois at Urbana–Champaign and degrees in mechanical engineering and psychology from Lehigh University. His research enhances the safety and acceptance of complex human-machine systems by considering how technology mediates attention. Much of this work concerns emerging technology for cars and trucks, where it focuses on technology that can distract drivers and technology that can mitigate distraction. He is a member of the National Academy of Sciences committee on human factors and the National Academies committee on the preventing teen motor vehicle crashes. Dr. Lee serves on the editorial boards of *Cognitive Engineering and Decision Making, Cognition, Technology and Work* and *International Journal of Human Factors Modeling and Simulation* and is the associate editor of transportation for the journal *Human Factors*.

Overcoming barriers to creating a well-functioning safety culture:
A comparison of Australia and the United States

Allan F. Williams and Narelle Haworth

Introduction

An effective highway safety culture is an environment in which public and political attention is paid to motor vehicle injuries commensurate with the size of the problem, and there exists a balanced, evidence-based approach for reducing the problem, incorporating behavioral, environmental, and vehicle factors. There are barriers to achieving an effective safety culture, largely having to do with the psychology of driving. These barriers are discussed in the context of the United States, which has a weak safety culture. Other countries have made greater strides in overcoming these barriers. One such country is Australia. The experience of Australia is discussed in relation to the United States, and an assessment is made of what can be learned from this comparison about establishing a more effective highway safety culture.

The United States situation

There is a significant highway safety problem in the United States. More than 40,000 people have died in each of the past ten years, and death rates per capita, per miles driven, and per registered vehicles have declined only slightly during this period (National Highway Traffic Administration 2004). There is no mystery as to how and why injuries occur. Simply put, they occur when the energy released in collisions exceeds the human injury threshold. This is a man-made problem, and societies can choose the extent to which they control it.

High-speed mobility is dominant in the United States. Very high speeds are allowed on many highways and speed limits are routinely exceeded (Insurance Institute for Highway Safety 2003). The horsepower of the vehicle fleet has increased in recent years, with many vehicles having speedometers that reach 160 miles per hour, twice the highest speed limit. Vehicles are blatantly advertised for their power and performance characteristics (Ferguson, Hardy, and Williams 2003). Most importantly, there is not a sufficiently safe vehicle and road infrastructure for prevailing speeds on the road network (Johnston 2004b).

Apathy toward the problem

Unfortunately, both government and the general public are pretty much accepting of the large yearly toll of injuries and deaths, the byproduct of mobility. They are part of the fabric, seemingly acceptable collateral damage. Dinesh Mohan (2003) writes: “Road traffic injuries are the only public health problem for which society and decision-makers still accept death and disability among young people on a large scale. This human sacrifice is seen as a justifiable externality of doing business: the only discussion revolves around the number of deaths and

injuries that are acceptable." Whether this is a conscious acceptance, based on an accurate knowledge of the size of the problem, or stems from a lack of understanding, is an issue that deserves further research.

It is customary to attribute the apathy toward the problem to the fact that although there are more than 100 highway deaths on an average day in the United States, they happen primarily in ones and twos scattered around the country, and the total death count for the day is not known until many months later. From 1996 to 2002, the single-day fatality count ranged from a low of 45 to a high of 252, with a daily average of 117. Ninety-four percent of the deaths occurred in crashes where one or two people died (Farmer and Williams 2005). The contrast is usually made with commercial airline crashes, which effectively capture public attention and concern, and in fact, Secretary of Transportation Secretary Norman Mineta has reportedly said, "If we had 115 people die per day in aviation crashes, we wouldn't have a plane in the sky." (Kristof 2004)

The large number of fatalities per year also has another, perhaps subtler, influence on the way that the highway deaths are perceived. A statistical feature of such large numbers is that they do not vary by a large fraction from year to year, unlike smaller numbers such as commercial airline crashes or passenger train crashes which can easily double from one year to the next. The relative stability and predictability of the number of highway deaths gives an aura of being under control, suggesting there is no crisis to which we must respond. The largely unvarying number of yearly deaths and the manner in which highway deaths are distributed and tallied may be reasons why the highway safety problem remains in the background, but this is not the whole story.

Psychology of driving

The primary issue in our approach to the problem has to do with the psychology of driving. We all drive. We all know that crashes often happen, and it is apparent that driver behavior is usually a contributing factor. The link between driver behavior and undesirable outcomes is much more obvious than in the case of diseases, where behavioral antecedents are often not so clear or immediate.

People think, in general, that they are less likely than the average person to encounter negative events, and this is particularly the case for driving. It is well known from risk-perception research that in very familiar activities there is a tendency to minimize the possibility of bad outcomes as a way of allaying personal concerns (Douglas 1985). People underestimate risks that are supposed to be under their control. They insulate themselves by creating "illusory zones of immunity" around routine, everyday activities (Jasanoff 1998). This sense of subjective immunity is bolstered by most people's beliefs that their driving and crash avoidance skills are above average. Surveys around the world have indicated that most people think their driving skills are superior. For example, in a United States study, 20% thought their skills were far above average, 52% thought their skills were above average, and the other 28% thought their skills were average (Williams, Paek, and Lund 1995). People think that with their special skills, they can largely control their crash involvement. One survey indicated that 37% thought they have almost total control in preventing their own involvement in motor vehicle crashes, 45% thought they had a lot of control, 15% thought some control, and 2% very little (Teknekron Research 1979). There is recognition that crashes happen, but they happen to other drivers, who are not so skilled or careful. It is the mythical "other driver" who is the problem. In the Teknekron survey, motorists estimated the likelihood of their being in a motor vehicle crash in the next year. The

true likelihood was calculated as 1 in 7, but only 18% said their chances were 1 in 10, 25% said 1 in 100, 24% 1 in 1,000, 12% 1 in 10,000, 13% 1 in 100,000, and 9% were not sure. These zones of immunity we create around ourselves help to engender public indifference. At one level, people understand that motor vehicle crashes and injuries are a problem, but it is somebody else's problem. As Ian Johnston (2004a) puts it, personal road safety is valued, but community road safety is not because people believe they can largely control their own safety.

We do have a vested interest in how others drive. We may view drivers who crash as victims of their own making, but they can also cause harm to us. We have a social contract with others that all will drive responsibly. The concern is that while we ourselves are competent drivers, others are not and they pose a threat to us. When drivers in the Teknekron survey were asked the likely cause of a crash if they happened to be in one, only 6% said it would be because they were at fault, whereas 59% said it would be the fault of the other driver or just bad luck (17%) or due to some roadway or vehicle factor (18%) or something else. We are quick to put the blame on other drivers, who make the highways more dangerous for drivers like us. This view is reinforced by the reality that the likelihood of a crash on any one car trip is extremely low, yet we observe that crashes (involving other drivers) are happening all the time.

Consequences

The low priority accorded to the highway safety problem and the attribution of the problem to the "other" driver has two consequences. First, it means that the field is woefully underfunded. This is evident when you "follow the money." In 2004, the U.S. federal budget for the National Cancer Institute was $3 billion, for the National Heart, Lung and Blood Institute $2.3 billion, and for highway safety research (the National Highway Traffic Safety Administration and the Federal Highway Administration) $164 million. These are huge differentials, even though in terms of adjusted years of life lost before age 75, cancer and heart disease are each only 2 to 3 times that of motor vehicle injuries. The National Institute of Dental Research received $349 million for research in 2004, more than twice what was spent for highway safety research.

Secondly, the approach to dealing with the highway safety problem has been limited and often misdirected, effectively wasting some of the scarce funds received. Behavioral strategies have been relied upon as the primary approach to the problem. We blame people for driving poorly and getting into crashes, and we don't want their misbehavior to hurt us. As Dinesh Mohan (2003) says, "If human error is seen as the root cause of road-traffic injuries, it follows that the solution must be the education of road users…This mindset has continued in the face of all scientific evidence that educating road users is not the most effective way to reduce road-traffic injuries."

This approach to the problem has resulted in many programs being embedded without regard to evidence of their effectiveness or, indeed, in the face of evidence that they are in fact ineffective or even counterproductive (Insurance Institute for Highway Safety 2001). This is in sharp contrast with the introduction of measures for the alleviation of other public health problems.

One reason the success of public information and education programs is limited is that we all pretty much know what we are supposed to do and not do on the highways. What we do, however, is another matter, often unrelated to knowledge about the appropriate behavior. Moreover, safety messages are easily deflected. Skilled drivers such as ourselves are safe drivers;

safety messages are obviously aimed at other drivers who need such education, not ourselves. In one study, it was found that drivers exaggerated the perceived speed of other motorists, believing that they themselves drove slower and, thus, were inclined to ignore campaigns urging people not to speed (Walton and McKeown 2001). If, at some level, we recognize that the messages pertain to us, we ignore them.

Educational programs for motorists remain popular. In one survey, 80% of drivers in the United States said that they thought the number of serious injuries could be reduced by increased public education efforts (Boyle and Sharp 1998). There are still programs, such as a recent campaign in the United States which used federal and other money to "raise awareness about the dangerous and costly problem of running red lights." It seems highly unlikely that any adult (or child for that matter) does not know that you are not supposed to run red lights and programs like this, rarely subjected to evaluation, are unlikely to have any effect.

The irony is that while much money and effort have been spent on ineffective "feel-good" programs, there is a vast array of measures, shown by research to reduce the problem, that are grossly underused. There is, according to the National Academy of Sciences a "yawning gap" between what we know and what we do (Bonnie, Fulco, and Liverman 1999). Ian Johnston (2004b) notes that "the gap between knowledge and action in road-traffic injury prevention is arguably the widest among the major public health issues." The public apathy that besets the problem of motor vehicle injuries and the human-failure bias do not readily engender the political will to implement effective policies and practices.

Of course, great advances have been made through a public health, or systems, approach, embodied in the Haddon matrix. The emergence of this more sophisticated approach helped move the field away from exclusive attention to the precrash human cell of the matrix, to include

approaches focusing on vehicles and the environment. Such approaches involving roadway-engineering and vehicle-design changes provide many opportunities both to avoid crashes and to reduce their severity. The intention is not to downplay these developments. Indeed, the United States is rightfully considered a world leader in vehicle design and roadway improvements. However, advances that have come through engineering practices and enhanced vehicle designs always seem to be accompanied by pleas to get back to the real source of the problem, the irresponsible driver. It is as though we are letting these drivers off the hook by not addressing them directly. And, as Ian Johnston (2004a) has pointed out, the belief that most crashes involve blameworthy behavior is continuously reinforced by our justice system and our largely fault-based insurance system.

It should be noted that behavior-change attempts have not been limited to education programs for drivers. Laws and their enforcement have been effective in dealing with behaviors, such as seat belt use, alcohol-impaired driving, speeding, and motorcycle and pedal cyclist helmet use. However, other countries, in particular Australia, have used this approach more extensively.

News coverage of highway crashes also reinforces the driver-behavior emphasis, focusing on behavioral errors and encouraging fear of the "other" driver. In a study of newspaper reporting in four Midwestern cities in the United States, it was concluded that papers, "presented fatal motor crashes as mini-dramas, with clearly defined victims and villains. Papers underrepresented the proportion of drivers killed in fatal crashes by focusing disproportionately on those crashes in

which "at-fault" drivers survived to take the blame. Thus, the choice of stories covered and the narrative strategies employed give readers the impression that the undeserving and unsuspecting are more likely to be killed, while those whose mistakes contribute to crashes are more likely to survive." (Connor and Wesolowski 2004)

With some exceptions, politicians in the United States are not attuned to or informed about the highway safety problem. Leonard Evans concluded that "protecting public health is a major government responsibility and U.S. performance in the area of ground traffic safety has been abysmal compared with that of other countries." (Evans 2003)

To the extent attention is paid to the problem in the United States, it moves from issue to issue: alcohol-impaired driving in the 1980s, then "aggressive" driving, and currently "distracted" driving. Note that these are all types of drivers whose behavior can harm others; thus, the attraction.

A way forward

Given these background factors that work against an effective safety culture, how do we overcome them and create an environment that is more attentive and appropriately responsive to the highway safety problem? The psychology of driving that keeps the highway safety problem under the radar and skews our approach to it is thought to be universal. Indeed, others who have written about safety culture barriers, such as Ian Johnston and Dinesh Mohan, both quoted liberally in this paper, are from Australia and India, respectively. We need first to learn more about factors related to the psychology of driving. We need more in-depth studies of perceptions of the highway safety problem, individual risk perception, and attributions of risk, compared with other health threats, and the extent to which there are cross-cultural differences in these phenomena. Secondly, we need to learn from other countries that have made strides in overcoming barriers to an effective highway safety culture. The most prominent example is Sweden's "Vision Zero," with its enlightened view of the role of human behavior, basically, to encourage people to take responsibility to drive safely but also to protect them from injury even if they do not (Tingvall and Haworth 1999). Another example is Australia.

The Australian situation

Australia is often cited as an example of a country that has made much more progress in road safety than the United States and as an example of a country with a stronger safety culture. The remainder of this paper discusses the extent to which this assertion is true and some of the underlying political, cultural, and historical factors that appear to have shaped the differences between highway safety in Australia and the United States. In brief, these differences involve governments being more willing to intervene to protect people's safety and to adopt a scientific approach in doing so, support for safety initiatives from parliamentary committees focused on road safety and the availability of funds for safety endeavors, policies being easer to implement because there are fewer decision makers involved, and a public that is more accepting of government interventions, in part, because of intensive community education undertaken during pre-law periods.

Comparisons of highway safety performance between countries can often be misleading because of differences in the level of motorization and differences in the mix of road users and many authors have cautioned against these comparisons (Johnston 1991; O'Neill and Kyrychenko 2006). While these differences suggest it is unwise to compare Australia or the United States with many European or Asian countries, Australia and the United States are sufficiently similar on these dimensions to allow reasonably valid comparisons. The percentages of fatalities that are vehicle occupants are roughly similar in the US and Australia, and both countries have high levels of motorization. In the 1980s, the motor vehicle death rates per 100,000 population were similar in the United States and Australia. In 1981, the rates were 22 in the United States and 21 in Australia, and these numbers fell somewhat to reach 18 and 17, respectively in 1989. But the rates in the United States have fallen little since then, despite dramatic decreases in Australia. In 2004, the death rate was 15 in the United States and 8 in Australia.

Structure of government

There are many similarities between the United States and Australia. Australia is roughly the same size as continental US. Australia has a federal system of government, like the United States (but only since 1901). Similarly to the US, the powers of federal government are limited. The Australian States only yielded income taxation to the Federal Government during the 1940s, so until then it had few resources as well. In road safety, the Australian Federal Government has responsibility only for vehicle standards and national highways (and potentially advertising through its telecommunications powers). Thus, the issues of federal versus state division of responsibility and resources for highway safety are, on the surface, somewhat similar in the two countries.

Yet there are some important differences. Australia's 20 million people live in only six States and two Territories. The two most populous States (New South Wales and Victoria) comprise almost 60% of the national population. Local government in Australia has relatively little power compared to in the United States. There are no city or county police, only state police (the small Australian Federal Police has little to do with highway safety). These governmental factors have influenced the ability to implement highway safety measures in Australia. Decisions by only two Police forces (or by two driver-licensing authorities) to implement a new highway safety measure can affect 60% of the nation's drivers.

Another governmental difference is that Australia does not have a Bill of Rights. While there have been some moves towards such an approach, its opponents have argued that codifying individual rights will restrict them. Australia's legal system is based on the British system, and the Australian Constitution focuses on maintaining the rights of the States against encroachment by the Federal government, rather than maintaining the rights of individual citizens. Thus constitutional challenges to highway safety measures on the grounds of infringement of the rights of the individual do not occur in Australia.

Geography

Like the United States, the Australian States and Territories vary considerably in their road safety performance. In 2005, the fatality rates in the Australian Capital Territory (akin to Washington

D.C.) were lower than any Australian State or Territory and lower than any country in the OECD (ATSB, 2006), while the fatality rates in the Northern Territory were more than double that of the better-performing states. In general, these differences in fatality rates reflect differences in the extent of urbanization. Highly urbanized areas have lower crash rates. Better-quality roads and lower travel speeds in urban areas account for part of this pattern, but differences in safety culture between urban and rural areas are also important. In urban areas of Australia, there is intensive random breath testing to prevent drunk driving crashes and widespread use of speed cameras to reduce speeding crashes. These measures are not as feasible or successful in rural areas, and so the extent of drink driving and speeding and the resulting crashes are much greater in rural areas. Poorer emergency treatment also plays a role.

Relative emphases on different types of traffic safety programs

Despite their different traffic safety cultures, the US and Australia both have strong traffic safety programs in some areas. Very broadly, there are strong Australian programs that aim to prevent traffic crashes. Random breath testing to deter drunk driving and, thus, prevent drunk driving crashes is a widespread and intensive approach in Australia, whereas the US Constitution is interpreted as prohibiting this practice. The US approach to drunk driving involves some use of sobriety checkpoints but has been much more based on punishment than prevention. Vehicle impoundment for drunk driving occurs in some part of the US, while it is yet to be implemented anywhere in Australia.

Relative to Australia, there has been less government involvement in the US in changing driver behavior through laws and their enforcement. Australia led the world in passing laws in the areas of drunk driving, seat belts, and bicycle and motorcycle helmets, and accompanying these legislative changes with fairly massive amounts of enforcement and paid mass media programs.

Government has played an important role in improving traffic safety in the United States, however. The Australian perception is that traffic safety in the US has benefited from very large expenditures on better roads and on better vehicles. This perception has some support: our international benchmarking study of heavy vehicle safety (Haworth, Vulcan, and Sweatman 2003) demonstrated that the better levels of heavy vehicle safety in the United States than Australia could be largely ascribed to more travel on divided roads.

What does this mean for the argument that traffic safety culture is more developed in Australia than the US? The large US expenditures on better roads may not really be part of the traffic safety culture, but instead another manifestation of enhancement of individual mobility and freedom (which in other areas such as increased speed limits and lower licensing ages has actually worsened traffic safety).

The greater emphasis on vehicle safety in the US than in Australia has led to many US vehicles (let's forget SUVs) being safer than their Australian counterparts. Vehicle safety in Australia lags because only a relatively small proportion of vehicles are manufactured locally and this proportion has fallen in recent decades when emphasis on vehicle safety has increased. Thus, many imported Australian vehicles are "despecified" versions (i.e., with some safety features removed) of their overseas cousins. While the Australian Federal Government has responsibility for vehicle

safety, the Australian Design Rules are changed only slowly and so give little impetus for vehicle safety improvements.

Why is Australia's safety culture different?

Given that Australia's highway safety culture appears to be different, why is this so? The first point to be made is that the safety culture differences between the United States and Australia are not confined to traffic safety. Similar differences exist in terms of gun control and in health insurance (although government involvement in the latter is decreasing). In Australia, government appears to be more willing to intervene to protect the health and safety of the community than in the United States.

The acceptance of government intervention in Australia may not be a characteristic of the types of people who originally came to Australia (convicts who came as part of a dependent, authoritarian regime) as speculated by Johnston (1991), but because of traditional dependence on government to provide infrastructure and initiatives across a wide variety of areas.

Hancock was an Australian historian who coined the phrase "socialism without doctrine" to describe Australian politics. He maintains that Australians have developed a learned dependency on government that has a historical basis. In Australia much of the development of crucial infrastructure was done by government, e.g., development of the railways because of low population density and, therefore, the lack of an economic base to support private infrastructure. Another historian, Nigel Buckland, noted the huge growth of government-owned infrastructure in Australia in the 19th century which was financed by overseas borrowing.

The role of government in infrastructure development may have led to a habituation on the part of Australians to government control and ownership of infrastructure and other initiatives (with only a recent aberrant shift to economic rationalism). John Hirst, a Monash academic, argues from the example of South Australia that the state capital (and state government) was so important for outlying rural centers because low population density made local structures unsustainable, leading to a natural recourse to central government.

In contrast, private enterprise has historically been much more important in the United States.

Some of the effective traffic safety measures that have been implemented by Australian governments are not popular, and media criticism of governments commonly occurs. A telling contrast with the United States comes from an investigation of how Australia was able to achieve widespread adoption of speed cameras and what the United States could learn that might facilitate their greater adoption in the US. The same controversies about speed cameras were found to exist in both countries. However, Australian states, based on studies indicating the safety benefits of speed cameras, have maintained and even increased their use, whereas they have been resisted in the United States (Delaney et al. 2005).

In Australia, populist dislike and distrust of authority has always existed alongside the dependence on government for basic infrastructure services. This can be potentially reconciled as a disagreement with what government is doing, rather than a denial that they have the authority to undertake that course of action.

How effective measures have been introduced in Australia

In addition to the willingness to accept government intervention that has just been discussed, we have identified three factors that have assisted the adoption of effective highway safety measures in Australia. These are a willingness to take a scientific approach to highway safety, the existence of Parliamentary committees focused on road safety, and institutional responsibilities or arrangements that facilitate the implementation of road safety measures.

Willingness to take a scientific approach to highway safety

In Australia, there has been a history of road safety measures being introduced or expanded because of expert input and the results of local or international evaluations. This has both helped to get effective measures introduced and (generally, but not completely) to prevent the introduction of popular, but ineffective measures.

In Australia, community groups have played no major role in the introduction of effective traffic safety measures. There have been attempts to set up chapters of MADD in Australia, but they have been unsuccessful. Partly this may be because the public are satisfied with current government actions in combating drunk driving, but partly it may reflect the view that if additional measures are necessary, then government will ensure that this occurs, rather than public agitation being required.

Parliamentary committees as a mechanism for improving safety culture

The three most populous States (NSW, Victoria, and Queensland) and the Federal Government have Parliamentary Committees that conduct Inquiries into road safety matters. Each of these Committees has representation from all major political parties, thus minimizing party politics and promoting bipartisan support for its recommendations. While the Committees do not have legislative powers, for most of the Committees the Government is required to respond to the recommendations of the Committees within a set period (three or six months).

The role played by the Parliamentary Committees in the introduction of new road safety measures is not always direct but has been significant, particularly in Victoria (see Clark, Haworth, and Lenné 2005). The Inquiries gather material and discuss and air new road safety issues or proposed initiatives. This serves two purposes: it identifies or defuses opposition from interest groups, the public, or other political parties, and it also educates parliamentarians about road safety. The effectiveness of the Federal Committee is limited by the restricted role that the Federal Government can play in road safety but, nevertheless, its Inquiries have raised the profile of road safety issues such as truck driver fatigue.

Institutional arrangements

While Australia is sometimes viewed from abroad as a monolithic entity, in reality, the approaches taken to road safety have varied considerably among the States. The States have differed in the nature (overt versus covert, mobile versus fixed) and extent of speed camera programs and the nature, extent, and coordination with enforcement of road safety advertising. Since the mid-1980s at least, the different approaches may have reflected not so much difference in what people think, but in how institutional responsibility for road safety is organized, which influences the amount of resources available to be distributed.

In Victoria, all vehicle owners are required to pay their compulsory third-party injury-insurance premium to the government-owned Transport Accident Commission (TAC) which is required as part of its Act to undertake road safety measures. Beyond its legal requirements, the Transport Accident Commission has spent large sums on road safety advertising and other initiatives (e.g., purchase of improved breath-testing and speed-enforcement equipment for the Victoria Police tied to evaluation requirements), viewing this expenditure as investments in reduced claims, rather than as "dead money." In addition, the Victorian Government has extracted dividends from the TAC to pay for large-scale programs to treat hazardous road locations.

This paradigm has identified the importance of identifying the organizations that benefit financially from improvements in road safety. If such organizations treat road safety expenditures as investments, then they will also fund evaluations to monitor the process of implementation and to measure the road safety benefits (particularly in terms of their own financial performance). Thus, the investment cycle becomes sustainable.

Yet this does not work for all organizations. The public health system benefits financially from reductions in hospital admissions and presentations resulting from successful road safety initiatives, but does not "make" money. Even in Victoria, the public health system does not invest in road safety.

In New South Wales and Queensland, the government acts as a regulator of compulsory third-party injury insurance, rather than as a monopoly insurer. In these States, the regulator has a keen interest in road safety, but relatively little revenue to use to influence the implementation of road safety measures.

At least in some States, Australia is different, not just in the types of road safety measures that have been introduced, but also in their magnitude. Evaluations have shown that there is a threshold for effectiveness for some programs (e.g., random breath testing and, perhaps, road safety advertising) that means that limited investment may not give proportional returns. Part of this threshold effect is that the perceived risk of detection by enforcement needs to reach a certain level before widespread behavioral change occurs. A more subtle contributor is that Government needs to show by its allocation of resources that it is serious about an issue before the public will also become serious. In this way, the safety culture functions by having the government leading the way.

Public education to reduce the "other driver" effect

One of the psychological factors identified earlier in this paper is the "other driver" effect, where drivers consider that they are safer than other drivers and that the other driver causes crashes and, therefore, should be the subject of education and enforcement. While some Australian researchers point out that this effect still exists in Australia (e.g., Tay and Watson 2002), the coordination of high levels of public education and enforcement has targeted these views with some measure of success. We identify three components of this approach that have contributed to changes in driver behavior.

Firstly, the public education campaigns included advertisements where the harmful outcome was being detected by Police and fined or arrested, rather than a fatal crash. Thus, the consequence was changed from one which was a statistically unlikely event (which could be argued would only happen to other drivers) to a statistically much more likely event (particularly given the high levels of enforcement that accompanied these campaigns).

Secondly, the public education campaigns involved extensive research to maximize their effectiveness in changing driver behavior. Messages and concepts were pretested with focus groups of the target audience, ongoing audience monitoring was undertaken, and evaluations of the effects on the target crash types for the target populations were undertaken. This allowed campaigns to be designed and modified to increase their effectiveness. For example, pretesting and other research identified that young people were more concerned by disfigurement and disability than death. This led to an advertisement that stressed disability and the pain and social isolation associated with rehabilitation.

Thirdly, the drivers in the advertisements were portrayed as ordinary people in ordinary situations, rather than villains. For example, speeding was detected as something that a mother might do in hurrying to pick up her child or fatigue might be part of leaving for a holiday trip. The aim was to create scenarios that the target audience could identify with.

Next steps for Australia

The reductions in fatality numbers and rates in Australia have slowed in recent years, and this has been a cause for concern and a catalyst for reassessment of strategic approaches. In some States of Australia, there is increasing realization that the big advances possible from behavioral-control strategies have been achieved and that while the effort is needed to maintain these advances (e.g., maintain the level of deterrence of drunk driving), significant breakthroughs require other approaches. In other States, there is still much that could be done to improve behavioral-control strategies for speeding (e.g., introduce more covert speed cameras). In rural and remote areas, the behavioral control strategies that have been so successful in some cities have not proven to be feasible because enforcement is relatively difficult. Thus, the Australian

National Road Safety Strategy and the newly developing strategies in Victoria and Western Australia are focusing less on interventions to change driver behavior and more on moving towards a safe system. The safe system approach is, in essence, an Australian adaptation of the European Vision Zero and Sustainable Safety models. It could be described as Vision Zero without the moral imperatives. The 2005 and 2006 Action Plan for the Australian Road Safety Strategy (ATC undated) introduces the Safe System concept as the "overarching framework for road safety intervention". This approach emphasizes the ways in which the safety of roads and roadsides, speeds, and vehicles combine to affect total road trauma.

Australia still has a long way to go to achieve an optimum safety culture. The need to match speed limits to road infrastructure quality has been identified as one of the fundamentals to producing a Safe System, but speed limits are still often the same on divided and undivided roads, 2- and 4-lane roads, and sealed and unsealed roads. Unless there is a reassessment of the relative costs of lives saved and time delays used in calculating the benefits and costs of road safety initiatives, the matching of speed limits and road-infrastructure quality will remain biased toward mobility and away from safety.

Some steps towards creating a better-functioning traffic safety culture

As part of the development of this paper, several steps to creating a better-functioning traffic safety culture in the United States have been identified.

Firstly, there is a need to investigate what the US public knows about the size of the highway safety problem and effective measures. This would help us to know how much the government and public acceptance of traffic injuries and deaths result from lack of knowledge, rather than conscious acceptance and could guide strategies to change this apathy. Potentially this investigation could form the basis of a credible, ongoing monitoring system that could be used to measure the effects of public education and changes in safety culture in the US (modeled on Community Attitudes to Road Safety surveys in Australia).

Secondly, we need to find out more about where is it best to put efforts in changing the highway safety culture. For which issues, when and how should we target the public, bureaucracy, or politicians?

Thirdly, the paper found that there are strengths in some areas of safety culture in the US, specifically in relation to roads and vehicles. It would be useful to identify what currently exists in both cultures that can be used as a resource to create a well-functioning (or better-functioning) traffic safety culture.

Fourthly, we know that there are stronger safety cultures in some other transport modalities such as aviation and rail. It may be useful to investigate how they got to where they are and whether we can recreate or adapt some of these factors to improve highway safety culture.

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References

ATC. undated. *National Road Safety Action Plan 2005 and 2006*. Canberra: Australian Transport Council.

ATSB. 2006. *International road safety comparisons. The 2004 report. A comparison of road safety statistics in OECD nations and Australia*. Canberra: Australian Transport Safety Bureau.

Bonnie, R. J., C. E. Fulco, and C. T. Liverman, eds. 1999. *Reducing the burden of injury,* Institute of Medicine: National Academy Press, Washington DC.

Boyle, J., and K. Sharp. 1998. *National Highway Traffic Safety Administration customer satisfaction survey.* DOT HS 808 797, Washington DC.

Clark, B., N. Haworth, and M. Lenné. 2005. *The Victorian Parliamentary Road Safety Committee–a history of inquiries and outcomes* (Report No. 237). Melbourne: Monash University Accident Research Centre.

Connor, S. M., and K. Wesolowski. 2004. Newspaper framing of fatal motor vehicle crashes in four Midwestern cities in the United States, 1999–2000. *Injury Prevention* 10:149–53.

Delaney, A., H. Ward, M. Cameron, and A. F. Williams. 2005. Controversies and speed cameras: Lessons learnt internationally. *Journal of Public Health Policy* 26 (4): 404–15.

Douglas, M. 1985. *Risk acceptability according to the social sciences*. New York, NY: Russell Sage Foundation.

Evans, L. 2003. A new traffic safety vision for the United States. *American Journal of Public Health* 93 (9): 1384–6.

Farmer, C. M. and A. F. Williams. 2005. Temporal factors in motor vehicle crashes. *Injury Prevention* 10:149–53.

Ferguson, S. A., A. P. Hardy, and A. F. Williams. 2003. Content analysis of television advertising for cars and minivans: 1983–1998. *Accident Analysis & Prevention* 35 (6): 825–31.

Haworth, N., B. Ungers, P. Vulcan, and B. Corben. 2001. *Evaluation of a 50 km/h default urban speed limit for Australia*. Melbourne: National Road Transport Commission.

Haworth, N., P. Vulcan, and P. Sweatman. 2003. Benchmarking truck safety in Australia. *Road & Transport Research* 12 (1): 64–70.

Insurance Institute for Highway Safety. 2001. Education alone won't make drivers safer. *Status Report* 36 (5), Arlington VA.

———. 2003. Faster travel and the price we pay. *Status Report* 38 (10), Arlington VA.

Jasanoff, S. 1998. The political science of risk perception. *Reliability Engineering and System Safety* 59: 91–99.

Johnston, I. J. 1991. Effective strategies for transport safety: An Australian's perspective. *1991 Westminster Lecture on Transport Safety.*

———. 2004a. *Improving road safety in the longer term—finding the right buttons to push*. Monash University Accident Research Centre, Melbourne, Australia.

———. 2004b. Reducing injury from speed related road crashes. *Injury Prevention* 10 (5): 257–9.

Kristof, N. D. 2004. 117 deaths each day. *New York Times*. March 13, 2004.

Mohan, D. 2003. Road traffic injuries—a neglected pandemic. *Bulletin of the World Health Organization* 81 (9): 684–5.

National Highway Traffic Safety Administration. 2004. *Traffic safety facts 2004*. DOT HS 809 919, Washington DC.

O'Neill, B., and S. Y. Kyrychenko. 2006. Use and misuse of motor vehicle crash death rates in assessing highway safety performance. *Traffic Injury Prevention* 7: 307–18.

Tay, R., and B. Watson. 2002. Changing drivers' intentions and behaviours using fear-based driver fatigue advertisements. *Health Marketing Quarterly* 19 (4): 55–68.

Teknekron Research, Inc. 1979. *1979 survey of public perceptions on highway safety.* DOT HS 805 165, Washington DC.

Tingvall, C., and N. Haworth. 1999. *Vision Zero—an ethical approach to safety and mobility.* Presented to the 6th ITE International Conference Road Safety & Traffic Enforcement Beyond 2000. Melbourne, Australia.

Walton, D., and P. C. McKeown. 2001. Drivers' biased perceptions of speed and safety campaign messages. *Accident Analysis & Prevention* 33: 629–40.

Williams, A. F., N. N. Paek, and A. K. Lund. 1995. Factors that drivers say motivate safe driving practices. *Journal of Safety Research* 26 (2): 119–24.

Biographical statements

Allan F. Williams is a Social Psychologist with a Ph.D. from Harvard University. He has spent his career doing research on social issues, including drinking behavior, preventive health behavior, and motor vehicle injuries. In 1972 he joined the Insurance Institute for Highway Safety, where he held various positions in his 30+ years there, retiring as Chief Scientist in 2004. Dr. Williams is now consulting on highway safety issues. He has published more than 300 articles in a wide variety of areas, with emphasis on young drivers, alcohol and other drugs, occupant restraints, and the status of highway safety as a social problem.

Dr. Williams has received a Widmark Award from the International Council on Alcohol, Drugs and Traffic Safety, and a Public Service award from the National Highway Traffic Safety Administration. In 2006 he received a Distinguished Alumnus award from Wesleyan University in recognition of his contributions to highway safety.

Narelle Haworth is Professor in Injury Prevention and Rehabilitation at the Centre for Accident Research and Road Safety–Queensland, Australia. Prior to her current appointment she spent 18 years at the Monash University Accident Research Centre in Melbourne, Australia, where she led research projects in almost all areas of road safety, including fatigue in driving, seat belt wearing by truck drivers, road user behavior in developing countries, improving data collection methodologies, driver training and licensing, coin-operated breath testing, motorcycle safety and single vehicle crashes. In addition to undertaking research, Narelle has assisted States and large organizations in the development of road safety strategies and provided advice and monitored their implementation. is Professor in Injury Prevention and Rehabilitation at the Centre for Accident Research and Road Safety–Queensland, Australia. Prior to her current appointment, she spent 18 years at the Monash University Accident Research Centre in Melbourne, Australia, where she led research projects in almost all areas of road safety, including fatigue in driving, seat belt wearing by truck drivers, road user behavior in developing countries, improving data collection methodologies, driver training and licensing, coin-operated breath testing, motorcycle safety and single vehicle crashes. In addition to undertaking research, Narelle has assisted States and large organizations in the development of road safety strategies and provided advice and monitored their implementation.

The role of public surveys in measuring program effectiveness and improving road safety

Paul Allen and G. William Mercer

Overview

Responsibility for reducing road-related injuries and fatalities lies in the hands of a large number of diverse groups. Collectively, the ultimate goal is to reduce casualty rates; individually, each group sets about accomplishing this task with different tools, different methods, and ultimately different immediate and measurable objectives. Thus, while casualty rates are the most significant measure of safety for a given jurisdiction, they are not and should not be the sole determinant of whether success is being achieved or not. Safety performance must be measured on more than one front, which is why acquiring data from other sources is so important. One type of data that is often overlooked in many jurisdictions is that derived from public surveys.

In the past three decades, the practice of polling has evolved and matured along with the technology that supports it. As a result, public surveys are now routinely used to help decision makers in almost every area of public policy development *except* road safety. For the most part, the three "Es" of road safety—enforcement, engineering, and education—are funded from the public purse through taxes and fees, yet these funds often are disbursed without the benefit of public advice or opinion. In the few jurisdictions where surveys are regularly used to measure and promote road safety (e.g., Australia, New Zealand, Europe, UK), the populations seem to have a more mature and consistent attitude toward road safety issues, partially evidenced by a media that is more engaged, more critical, or, at the very least, more interested in road-safety issues.

Organizations that use public surveys consistently do so to determine not only general attitudes towards road safety but also, and more specifically, to measure indicators such as driver experience with enforcement, their self-reported driving behavior, their perception of the likelihood of being detected and fined for contravening the rules of the road, and so on. Many of these surveys are conducted as part of independent research projects, while others form part of ongoing rolling poll and omnibus surveys that enable long-term trend tracking. The information extracted provides police, government, and other agencies with valuable data to help measure the effectiveness of their programs and to develop improvement strategies. If made available publicly, the information also generates more media interest, elevating the issue of road safety within the public consciousness.

Social change is slow, as witnessed by the twenty years required to change attitudes, knowledge, and behaviors around the issues of impaired driving and restraint device use. It is only through regular and consistent measurement that these changes can be tracked.

Introduction

"We need safer drivers, in safer cars, on safer roads."—(EuroRAP 2005)

Making this vision a reality requires the application of an integrated mix of education, engineering, and enforcement to modify driver behavior. Whether it is educating and training new drivers, deterring dangerous driving through fines and sanctions, or providing drivers with the means to make better decisions through intelligent vehicle and highway design, influencing driver behavior is a primary objective for improving road safety. It has been so since vehicles first began rolling off assembly lines.

But do the more common measures to improve safety really work? Do stiffer fines and penalties actually deter dangerous driving? Is traffic enforcement effective or as effective today as it was twenty years ago? Do graduates of driving schools crash less often than drivers without formal training? Certainly, many research projects have been conducted by various agencies, but what is arguably missing is outcome-focussed evaluation supported by ongoing measuring and monitoring.

The challenge lies in linking the activity or output (e.g., speed enforcement, seatbelt advertising, sobriety checkpoints, etc.) to the desired outcome (e.g., fewer people speeding, increased seatbelt usage, fewer people drinking and driving, etc.). How each group defines success also adds a level of complexity. For instance, high-profile traffic enforcement blitzes on long weekends are now common throughout Canada, but the data that police release to the media pertaining to the number of charges is difficult to interpret from a safety perspective. Are more charges laid an indication of success (i.e., more people were caught) or rather a failure (i.e., more people were undeterred). The answer, of course, depends on one's view of the role of enforcement. However, unlike charge rates which are highly susceptible to interpretation, public surveys can provide a reliable and accurate measure of deference to traffic law enforcement and to the rules of the road, the perceived risk of apprehension, and self-reported driving behavior. Similarly, tougher laws, fines, and sanctions are also assumed to possess a deterrent value; therefore, their true effect on driver behavior can be measured using surveys.

The historical difficulty of drawing a conclusive causal relationship between output and outcome at least partly explains why some generally accepted practices such as tougher fines and sanctions and conventional traffic enforcement are not routinely subjected to this level of analysis. This is in stark contrast with their more political counterparts, such as photo enforcement and red-light cameras, which typically undergo intense scrutiny. As a result, evaluation strategies built around measuring the individual effects of these conventional strategies are more or less ignored in favor of a high-level approach that links the collective efforts of the various groups to jurisdictional casualty rates—a relationship that no doubt exists, but that provides little value in the detailed measurement of the efficacy of policies, programs, and practices.

Relying on crash data to measure program effectiveness and overall road safety is a questionable approach based on the fact crashes are often underreported and unreliably reported (especially the less serious incidents) and the fact they are relatively rare occurrences. Thus, by simply looking at crash rates to determine the overall level of safety, proponents of this approach could be ignoring potentially effective programs and interventions. On the other hand, changes in knowledge, attitude, and self-reported behaviors can be measured with little difficulty and a high

level of accuracy using surveys. Experience also suggests that in addition to monitoring public awareness and self-reported behavior, properly structured surveys can also help establish road-safety priorities and stimulate interest in road safety.

While public surveys are not without their limitations as an analytical tool, properly conducted, they add depth and context to existing program evaluations and performance-monitoring exercises. In the wrong or inexperienced hands, however, surveys can yield misleading or vague results (obvious or suggestive questions leading to desired but inaccurate results, for example).

Public surveys are most useful when a cross-section of question types are asked and when used in conjunction with other data sources, particularly as part of an evaluation of a specific program or initiative. The former ensures the data extracted goes beyond the superficial (e.g., "Of the 20 percent of respondents who say they very frequently exceed the posted limit, only one percent reported having been ticketed in the past two years," etc.) and is therefore of value. The latter adds depth and insight to existing evaluation frameworks and often helps support the findings.

To ensure the credibility and legitimacy of public surveys and the data they produce, it is essential they be conducted by skilled practitioners with both traffic-safety program and measurement expertise and who have a broad understanding of core traffic-safety issues and programs. It is also important that the organization conducting the surveys is independent and objective, and ideally at arm's-length from the programs being measured.

The financial, logistical, and political barriers to using surveys to measure traffic-safety programming are by no means insurmountable. Evidence from organizations worldwide suggests that routine, in-depth public surveys can become as institutionalized as the common measures in place to improve road safety and can become integral to the evaluation of individual initiatives and overall jurisdictional performance.

Public surveys and road safety

Public surveys and the practice of polling have become more prominent over the past several decades. In an analysis of public-opinion polling in Canada, for instance, Claude Emery pointed out that:

> *Public opinion surveys assumed an immense importance in Canada in the 1980s; not only did they become a familiar and seemingly indispensable feature of political campaigns—with various professional polling agencies being commissioned by different media outlets and political parties—they became an important aspect of public policymaking. Although governments have other means of gauging public sentiment—party activists, members of caucus, public servants and their numerous client groups, legislative debates, the print and electronic media—polls are now acknowledged to be one of the most significant communication links between governments and the governed.* (Emery 1994)

Not surprisingly, the amount of polling conducted on specific issues (e.g., education, healthcare, the economy, the environment, etc.) reflects their level of political priority. Unfortunately, transportation—and road safety specifically—do not rank highly, if at all, on most national public policy agendas. The polling firm Ipsos, for example, conducted a survey each year between 1990

and 2004 to identify the issues Canadians feel require the greatest attention from their leaders. Based on a "first mention," "second mention" elicitation technique, the issues of healthcare, education, and the economy remained the top priorities year after year. It wasn't until 2003 that the issue of "highway infrastructure" even made it on to the list where it ranked twenty-seventh out of thirty issues, yet was still deemed less important than "Mad Cow Disease," which ranked twentieth (Ipsos 2004).

The role of public surveys

Despite its relative obscurity on the public policy front, road safety has become (and remains) an important issue for groups ranging from governments, police agencies, and insurance companies to advocacy groups, automobile associations, and injury-prevention agencies. Public surveys are a valuable source of information for all, many of whom either periodically or routinely conduct surveys. Arguably, the four most common reasons are to:

1. Increase and measure public attitudes toward road safety, new regulations, legislation, or countermeasures (i.e., red-light cameras).
2. Generate media and public interest.
3. Assist in establishing priorities.
4. Measure program effectiveness.

From a public policy perspective, surveys have been used more as a barometer to gauge public opinion for proposed government amendments to licensing laws and traffic regulations or new enforcement measures, rather than as a program evaluation tool. Public surveys are also used by state and national highway authorities (Federal Highway Administration, Transport Canada, etc.) to measure public satisfaction with the road network and perception of overall safety and to identify public priorities and preferred approaches to solving transportation problems.

Insurance companies use surveys not only to measure customer satisfaction and knowledge about product or coverage types and rating structures but also to glean information related to self-reported driving behavior, driving patterns, and driver awareness of the relationship between tickets and insurance premiums. In a survey released by Progressive Insurance in 2004, for example, "Ninety (90) percent of respondents said they drive over the posted limit, and 39 percent said they drive over the posted speed limit more than 25 percent of the time." (Progressive 2004)

Surveys are also popular with advocacy groups and foundations wishing to not only accumulate knowledge but to influence public opinion, government, industry, and so on. One of the most recognized and successful advocacy organizations in the area of road safety is Mothers Against Drunk Driving (MADD). In addition to their public awareness and education activities, MADD periodically sponsors public surveys to measure general awareness and attitudes towards the issue of impaired driving as well as the level of support for measures, such as tougher fines and sanctions, more sobriety checkpoints, and lowering of the legal BAC. MADD also routinely

conducts surveys of the legislation, enforcement activities, and education campaigns, that they subsequently use to grade the performance of the appropriate province or state.

Benefits of surveys

Measuring performance

On a macro level, public surveys, performed consistently, can be very useful in measuring and tracking public attitudes, knowledge and behaviors, deference to traffic law enforcement, general awareness, and safety culture overall. The New Zealand Public Attitudes Survey, which has been undertaken periodically since 1974 and annually since 1994 by the Land Transport Safety Authority (LTSA), is an excellent example of how attitudes and behaviors can be tracked over time (LTSA 2005). (See Figure 1 and Figure 2.)

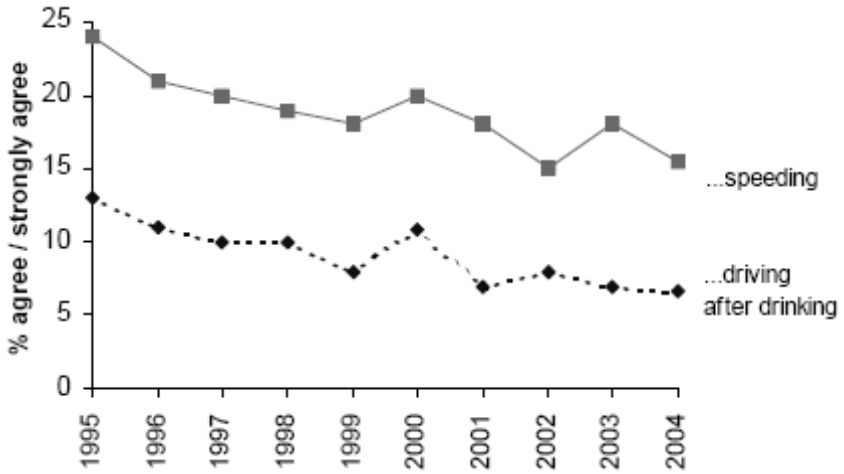

Figure 1. People who agreed that there isn't much chance of an accident if careful when… (Source of figure: LTSA 2005).

On a micro level, public survey data can be used to evaluate the effectiveness of individual programs and initiatives and to enhance program effectiveness. The results of the European SARTRE (Social Attitudes to Road Traffic Risks in Europe) Project, which was conducted in phases between 1991 and 1997 across fifteen countries, provides an excellent example of how the findings can often contradict conventional wisdom. Among other discoveries, the SARTRE study revealed that in some jurisdictions, drivers who had been penalized for speeding during the three-year period prior to the survey were most likely to report that they exceed the speed limit more frequently than other drivers. Moreover, these drivers were least concerned about road safety, least supportive of more enforcement or harsher penalties for offenders, and more likely to warn other drivers about speed "traps." (SARTRE 1998)

Surveys are also useful because they can provide data in a comparatively short time frame. Obtaining an adequate post-intervention sample of crash data usually requires a minimum of two years. Similarly, acquiring criminal code and highway traffic act offense data is a time-consuming endeavor more often than not.

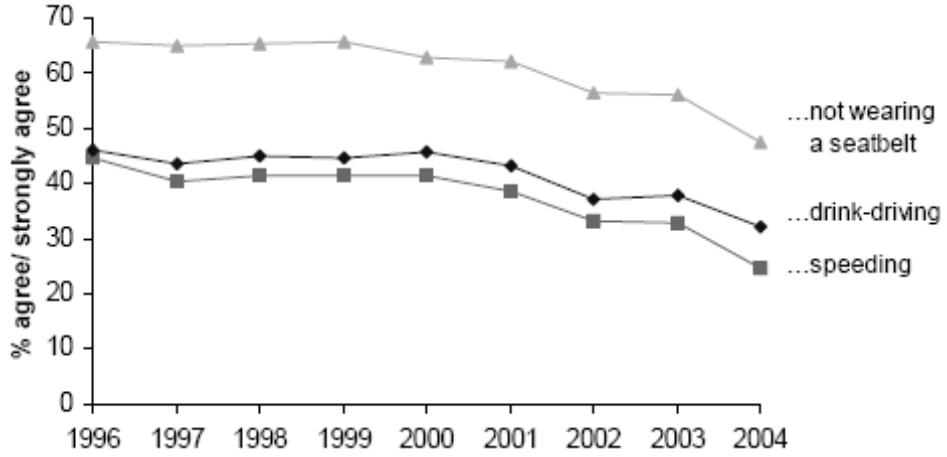

Figure 2. People who agreed that the risk of being caught is small when…
(Source of figure: LTSA 2005)

Influencing change

Alan Andreasen, founder of the Social Marketing Institute in the U.S., notes that, "Good social marketers begin by saying: I need to know everything I can about those whom I am supposed to influence." (Andreasen 1995) In this respect, public surveys play a vital role in the development and evaluation of effective marketing and public awareness campaigns. Arguably, limited market research prior to initiating campaigns is one of the reasons education and awareness programs have drawn criticism in recent years. In its May 2001 Status Update, which focussed on what works and what doesn't, the Insurance Institute for Highway Safety (IIHS) stated that:

> *The focus has expanded from trying to prevent crashes by educating people to change their behavior. This approach was too narrow. And it failed because education alone almost never changes driver behavior… But when it comes to changing the behavior of drivers and others on the road, research findings often are ignored. Many programs are based on wishful thinking instead of science. (IIHS 2001)*

Indeed, experience suggests that this is often the case when it comes to road-safety education campaigns—where not enough (or any) research (perhaps, surveys or focus groups) is conducted in advance to properly tailor the campaign to the intended audience.

Of course, much depends on the definition of "education." Too often it is used to describe the learning of a few road-safety "facts" or slogans—"speed kills" or "don't drink and drive"—when what it ought to be is the instilling of safety-related attitudes and beliefs that result in safety-related behaviors. That is, education in the broad sense, not just the memorization of dry facts. However, in order to educate, one must first know the current levels of knowledge, attitudes, and

behaviors that make up the background for the education, and that is where survey work is essential. “To change, you must first know what you are changing.” Following that, differing approaches (e.g., persuasion or threat) and programs (e.g., advertisement or enforcement) can be attempted and change (or lack thereof) can be tracked, again using survey techniques.

In addition to supporting campaigns designed to influence driver behavior, public surveys can also prove useful for influencing policymakers. Unfortunately, the historical landscape in this regard is dotted with more missed opportunities than success stories. In an article written for the *Miami Herald* in January 2005, the author quoted some of the concerns safety advocates have with automobile advertising and the seeming horsepower race. He notes:

> *“Activists and officials worry that decades of gains from safer vehicles are being diluted by a new crop of hot cars, hot drivers, and overheated advertising. So, they're urging the federal government to help and organizing a safety “summit” to put on the brakes. The activists point to the growing number of cars equipped with engines with 400, or even 500, horsepower. They are unhappy, as well, about ads for the newest high performance cars that emphasize speed.”* (Miami Herald 2005)

In response, Jeff Runge, the Administrator of the National Highway Traffic Safety Administration at the time, was quoted in the article as saying, “I'm really not inclined to jawbone the industry into toning down their ads, but I would like them to be mindful of the messages being sent, particularly to younger drivers, about speed and performance.” (Miami Herald 2005) While it is possible that NHTSA’s position reflects popular opinion, it is also equally possible that it does not. The findings of a comprehensive survey may in fact reveal that there is strong public support for the U.S. government to more tightly regulate the advertising of automobiles, particularly with respect to speed and performance.

Legitimizing resource requirements

Growing populations combined with an ever-increasing number of competing priorities has inevitably lead to greater scrutiny of government and police expenditures. Transportation divisions within government, which are predominantly responsible for road safety, are certainly not immune to fiscal belt tightening; some would argue that they have, over the years, suffered disproportionately compared to other divisions, such as health and education. The same holds true for traffic enforcement: a function of policing which often declines during periods when police agencies are forced to conserve resources.

To help increase or simply sustain budget and resources, officials often use public-survey data to help justify departmental priorities and program expenses. In a comprehensive study of traffic enforcement in Europe conducted in 2002, Mäkinen and Zaidel referenced the importance of using surveys to determine driver needs with respect to enforcement. Citing the findings of the SARTRE project, they concluded that, “Politicians, authorities, TLE officials, and professionals are sensitive to public opinion because the ability to secure funds and implement programs depends, in part, on this public support.” (Mäkinen, Zaidel, et al. 2003) More specifically with

respect to enforcement measures and the police community, the SARTRE 2 survey identified a high level of concern for road safety, and widespread support for more police enforcement and harsher penalties for offenders.

Mäkinen and Zaidel concluded:

> *"This is an important finding for the police who typically have an increasing problem with funding their activities—and have to balance their available resources with their perception of public and social needs as well as the views of the public and politicians." (Mäkinen, Zaidel, et al. 2003)*

Obviously the information gleaned from public surveys—no matter how supportive of more enforcement or programming, for example—does not guarantee approval of new resources or funds for new initiatives. However, if performed consistently and tracked over time, the information can help build the case for further funding or, at the very least, help minimize budget cuts.

Engaging the media

Public surveys can help to reinvigorate and prolong media interest in road safety, thereby stimulating public discussion and debate on various road-safety issues. Routine web searches for global media coverage of road safety reveal a disproportionate amount and intensity of media coverage between jurisdictions. In some jurisdictions, such as the UK, Australia, Europe, and some of the emerging nations, road safety is frequently highlighted in the press. Surprisingly, this is not the case in Canada or the United States.

Limitations of surveys and interpreting survey data

The three limiting parameters of survey data are sampling, reliability, and validity.

Regardless of how large or how demographically balanced (e.g., male to female, age, ethnicity, etc.) a survey is, its data will only reflect the responses of those who *agreed* to participate—the sample. That is, of course, unless researchers are dealing with purely objective, observational data, such as third-party observation of restraint-device usage. Participation levels can be increased to some extent using incentives, callbacks, and so on, but only those who want to express their views will participate; therefore, the results will reflect the biases of these cooperative participants.

On the other hand, presurvey or postsurvey sampling or "experimental group"/"control group" measurement can reveal changes in response data (assuming a well-constructed survey instrument with few changes in the measures used, unambiguous questions, clear response categories, etc.) Thus, reliable measures of the effects of campaigns like impaired driving road checks or speed and seatbelt enforcement blitzes can be obtained. Unfortunately, without this sort of multiple sampling, the data from a one-off survey can be of limited value.

Even with a large, balanced sample and reliable measures, the question of data validity remains. Are the variables measuring what they are supposed to be measuring? We must recognize that people lie, exaggerate, misremember, are not fully engaged in the process, or just don't understand the question. Unfortunately, there is little remedy for these outcomes, which is why survey data, in a perfect world, would be supplemented by other measures, such as observational data (and visa versa). For example, a survey on changing attitudes on seatbelt use could be supplemented with data from an observational survey, while one on impaired driving could be supplemented with random breath sampling.

Types of surveys and survey questions

Types of surveys

There are several ways to obtain survey data, depending on the type of research being conducted. These include telephone, face-to-face, mailed questionnaire, online, and observational. The two most common forms of surveys are telephone and online.

Telephone-based surveying is the dominant method used within the industry as it provides reliable and representative results within a relatively short time frame. Compared to online and mailed questionnaire surveys, telephone interviewing allows skilled interviewers to probe for more information. Historically, telephone surveys are more generally accepted and have more perceived legitimacy among external audiences.

Online or web-based surveys are more cost effective than telephone surveys. They also offer grid style questions for cross-tab analysis and the flexibility to create simple or complex surveys with skip logic which reduces "drop out" rates by skipping non-applicable questions, randomizing answer choices which minimize "order bias" (the ordering of choices within a question can introduce an unintended bias). They are often considered more convenient as respondents can complete the entire survey at a time that is most convenient for them or even in stages. Online delivery is most effective when surveying specific subgroups or organization members where email addresses are known and the surveying organization can be recognized by the potential respondent. Examples include police officers, Automobile Association members, coroners, physicians, and so on. (See Table 2 in the Appendix for examples of surveys.)

Types of survey questions

Public surveys normally contain a mix of hypothetical and factual questions pertaining to the respondent's knowledge, attitude, perception, behavior, and history or experience. Infrequently, quasi-psychological measures are included, such as aggression scales, anxiety scales, driving style scales, and so on. Depending on the purpose of the survey and the intended audience, one or all of the varying styles of questions could be included in a single survey. (See Table 1 in the Appendix for categories of survey questions.)

Maximizing the value of public surveys

Structuring surveys for analysis

Surveys can afford the opportunity to obtain precise and clear measures if they are brief and well constructed. This means that every data point in every variable should have a clear purpose, either as a predictor or outcome measure. In turn, the analytical strategies and measures should be determined before the survey is completed. Bearing in mind that some jurisdictions require publicly funded survey data to be generally accessible and that *Access to Information* or similar laws exist in many jurisdictions, poorly worded surveys (even those not initially intended for public consumption) can create unanticipated, counterproductive consequences. Researchers must be able to justify every variable and explain how it will be used in the analysis. Pretesting to eliminate variables without value and determine "holes" in the variable set can be also extremely useful.

When planning the survey and analyses, researchers should keep in mind that there will likely be both lay persons and experts interested in the results. Therefore, it is important that the variables and categories be constructed so that they can easily be laid out as cross tabulations, graphs, and charts when possible. If the intention is to use inferential statistics (chi-square, t-tests, ANOVA, correlation and regression are most common), distinction between statistical significance and predictive power should be kept in mind—large samples can show significance between variables with trivial predictive power.

Integrating surveys with other measures

Public surveys are most advantageous when used in conjunction with other data. Transport Canada, for example, conducts an annual national observational survey of seatbelt use (Transport Canada 2006). Trained observers stationed at predetermined intersections monitor and record the number of belted occupants in light-duty vehicles. Among the findings, the 2004/05 survey concluded that a higher percentage of female drivers wore seatbelts (93.9%) than male drivers (89.8%) in Canada, and that the rate of seatbelt usage in Canada is lower among the back seat occupants (84.9%) than among the front seat occupants (90.5%) (Transport Canada 2006).

A telephone-based survey on seatbelt use in conjunction with the observational data could delve further into the knowledge, attitudes, and behaviors of drivers with respect to seatbelts to answer other important questions that an observational survey cannot address. Are driving school graduates more likely to use seatbelts? Are drivers aware of the penalties associated with seatbelt noncompliance? Is a driver who was ticketed within the last year for not wearing a seatbelt more likely to report wearing a seatbelt at the time of the survey, and so on?

Establishing targets and benchmarking performance

Many jurisdictions have road-safety targets in place as part of high-level road-safety plans or visions. In Canada's "Vision 2010" (Transport Canada 2004), for example, the general target is a 30% decrease in the average number of road users killed or seriously injured during the 2008–2010 period over comparable 1996–2001 figures, while in Europe the target is to halve the number of deaths on European roads by 2010 (EC 2003). Using questions and baseline data from existing surveys, authorities could develop targets based on respondent knowledge, attitude, self-reported behavior, and experience.

Similarly, surveys conducted across multiple jurisdictions (states, provinces, municipalities, etc.) provide the capacity for one jurisdiction to benchmark its performance against another. For example, officials in Jurisdiction A may discover that the perceived risk of apprehension in neighboring Jurisdiction B is much higher or that self-reported drinking after driving is lower. This might then prompt officials in Jurisdiction A to investigate the performance gap and modify their programs by incorporating the practices in place in Jurisdiction B. Data obtained from the SARTRE 2 survey conducted in Europe provides a unique example of how interjurisdictional survey findings can lead to different approaches.

The SARTRE project

The SARTRE project was specifically designed as a comparative study that would enable different jurisdictions to learn from one another. In the words of the authors:

> *"All countries in Europe apply similar countermeasures to improve the safety of road traffic concerning drivers' behavior, everywhere speeding, driving under influence of alcohol, or wearing a seat belt are submitted to regulations. An interesting fact is that the various countries, beyond common aspects, obtain apparently different success in their policies to reduce road traffic risk."* (SARTRE 1998)

With respect to the issue of impaired driving and enforcement, the authors found considerable attitudinal differences between jurisdictions (See Figure 3), leading them to conclude that:

> "The attempt to reduce the alcohol risk in traffic in Europe needs the consideration of national and cultural differences. Low alcohol limits correspond to awareness of alcohol risk in traffic and to desirable habits regarding drinking and driving. For those countries where there is little support for a low alcohol limit, an increase of the awareness of the accident risk at low blood-alcohol concentrations is necessary." (SARTRE 1998)

The SARTRE survey also revealed considerable differences in behaviors and attitudes related to speeding and support for different countermeasures across jurisdictions. The apparent differences between jurisdictions led the authors to conclude that:

> "Differences identified between countries may mean that it is possible to find examples of "good practice" (and similarly "bad practice"). This might give indications for the less effective countries how they might improve their speeding problems. The results suggest that enforcement of speeding could be improved in a number of countries." (SARTRE 1998)

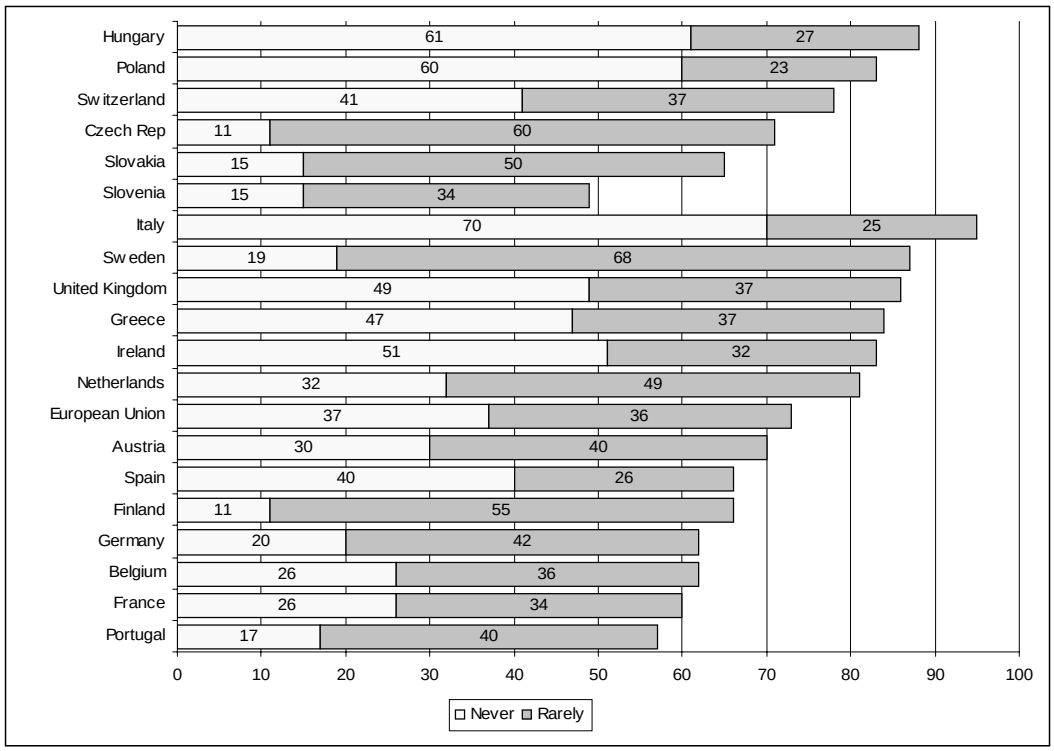

Figure 3. SARTRE 2 Results: On a typical journey, how likely is it that you will be stopped and breathalyzed?

The SARTRE project provides a unique example of how surveys can be specifically used to identify relevant interjurisdictional differences in attitudes and behaviors. Once documented, this information can lay the groundwork for jurisdictions to identify and subsequently share best-practices in order to improve their overall safety performance.

Demonstrably credible public opinion surveys put forward by trusted sources with reputations for integrity and impartiality on road-safety issues generally receive good to excellent coverage by news media in any North American jurisdiction. The key, however, is to move away from "one-shot," event-based coverage to continuing coverage of important road-safety issues. This can only be achieved through a comprehensive communications strategy that reflects a measured release of information gleaned from the survey and targets select audiences including the news media, governments, other industry stakeholders, and the general driving public.

Stimulating and sustaining media interest

A routine search for international road-safety news on the Internet consistently shows that while media across the world display a healthy interest in the topic, the volume and intensity of coverage on road-safety issues is frequently disproportionate between countries, states, and provinces. For example, while articles and broadcast segments about spectacular crashes, specific community concerns, and extraordinary traffic situations are common everywhere, news media in relatively few jurisdictions produce thoughtful and analytical coverage of broader road-safety issues and how these issues contribute to what the media sometimes refers to as the "carnage on the road."

An examination of many of the articles from the UK, Australia, and Europe also reveals a media that appears to be much more knowledgeable, more insightful, more critical, or, at the very least, more interested in road safety than their counterparts in North America. While it appears media in most countries report (albeit briefly and usually in conjunction with a staged media event or photo opportunity) on new road-safety initiatives, programs, and legislation, it seems the media in some jurisdictions are more prepared to address provocative and politically sensitive topics. These topics include the lack of government progress on casualty-reduction targets or the lack of traffic enforcement or general inaction by government or other third parties (including the private sector, such as insurance companies and road transportation organizations) to take steps to improve overall road safety.

While media coverage can draw significant attention and support to an organization's cause, it is most effective as part of an overall communications strategy. However, this should not downplay the importance of an effective media-relations strategy. To this end, a measured, graduated approach is recommended to support the public release of these survey results. Based on the questions and anticipated results, three high-profile results should be highlighted in three separate initiatives at three separate times. (Using three "results" is thought to fall between maintaining interest and media saturation.)

The first release could be tied to a media event (along with an accompanying media package), as simple as a news conference featuring subject experts to elaborate as a demonstration of the type of driving behavior described in the results. This would serve to draw immediate broadcast and print media attention to the immediate results. The second and third releases do not necessarily have to be as elaborate, but care should be taken to ensure that the subjects are of sufficient media interest and that the subject experts are immediately available for interviews, talk show appearances, and photo opportunities. It would have to be made clear to the media over this "story arc" that the survey is a work in progress and that they can expect additional relevant data to be analyzed and subsequently released over the following weeks (or whatever time period is deemed suitable).

This approach engages the media over a longer term and encourages longer-format, perhaps more analytical coverage. For example, high-profile radio talk-show producers could be

approached to arrange “day of release” appearances by the subject experts. Timing of the releases could be tied to other seasonal or societal events to maximize media and public attention.

Overall, this approach should help sustain media interest over a longer period and may encourage greater analytical and critical coverage of road safety as an issue for political administrations at all levels as well as the private sector and all citizens, not just drivers.

Challenges and considerations

There are financial, technical, logistical, as well as political and policy barriers to using surveys to measure traffic-safety programming.

Financial

The primary barrier to conducting telephone surveys is cost. As a rule, larger sample sizes provide more accurate results, more capacity to analyze the data through more precise subgroups (e.g., demographically), and the more credibility among external audiences. Typically, the sample size selected is largely dependent on tolerance for the margin of error and budget considerations.

To obtain the basic social science sample criterion of “correct within plus or minus five percent, nineteen times out of twenty” (which is not particularly accurate when attempting to measure relatively infrequent occurrences such as violations or crashes), researchers would need approximately 500 randomly chosen respondents matching a particular category, i.e., drivers. Obtaining this sample for even a brief survey can easily cost from $25,000 to $50,000, making it well beyond the entire budget of many traffic-safety programs.

As a result, online surveys are becoming a more appealing alternative as opportunity costs continue to decline with advances in technology.

Technical

Assuming evaluation funding is in place, developing an effective survey is a technical challenge. Many survey providers are willing to develop a survey based entirely upon a client’s suggested wording; consequently, surveys can be badly worded and constructed because the content experts are not survey construction experts and visa-versa. The ideal developer is a survey evaluation expert with a traffic-safety background, but there are only a few of these individuals in the field.

Logistical

Logistical issues center on sampling and sample access (mail, telephone, interview, email, driving logs, journals, etc.), survey timing, and survey frequency and continuity. In particular, program evaluation can be an afterthought, allowing for no pre/post or experimental/control structure. It can also be based upon uncertain or one-off funding, precluding measurement continuity over time. Clearly, if measuring improvement (if any) is the primary concern, then one-off measurement tools and measurement occasions are of little value.

A second logistical consideration occurs after the report is written and involves sharing the findings, assuming there is a desire to do so. Learned, peer-reviewed journals are not, for the most part, prepared to publish program evaluations unless the programs are massive and significant. Yet, for journeymen policy and program makers, the "grey literature" of surveys and local program evaluations is where important information about "what works" resides.

Political and policy

Political and policy barriers include a reluctance to evaluate at all—it's difficult to prove an error was made if no measurement is undertaken—and a reluctance to distribute or share findings. Additionally, if measurement is completed by the body that executed the project or supplied the funding and there is some measure of success, the result may be deemed biased and self serving.

Sustainability is an additional quasi-political issue. Traffic-safety issues and programs go in and out of fashion, vary with supporting organizations, and can actually change and evolve (e.g., alcohol-impaired to drug-impaired driving; restraint device use to air bags). Part of the problem lies in the classification of traffic events themselves: If an impaired, speeding driver in a heavy vehicle hits a juvenile pedestrian in a snow storm at an unsigned intersection, how would the crash be classified? What issue(s) should be addressed? Clearly, to measure changes in road safety, the core issues need to be assessed and defined, both broadly and impartially, along with the identification of key driver demographic and behavioral markers.

From the above, it can be argued that survey-based measurement of road safety would best be done by entities with the following characteristics and resources:

- Well-established with a credible reputation of integrity and impartiality
- Access to substantial and secure funding
- Access to both traffic-safety program and measurement expertise
- Arms-length from specific program implementation
- Capable of dissemination and archiving data, reports, and communications
- Having a broad understanding of core traffic-safety issues and programs

Summary and recommendations

Moving forward

Surveys can offer an efficient and sound way of measuring program effects and trends in traffic safety related knowledge, attitudes and behaviors, and can be particularly useful when combined with conventional data such as crash counts, contravention counts speed-loop data, and so on. It has also been noted that surveys can be poorly executed and are especially weak as "one-offs." Recognition and appreciation of the usefulness of survey data could be substantially improved.

In order to enhance the use of surveys and survey data, there are a number of steps that could be undertaken either independently or through a consortium of like-minded organizations with a similar commitment to improving road safety.

- Reviewing current and past surveys and survey methods to establish core traffic-safety and driver demographic issues and questions, which are then used by researchers to initiate data collection that could be compared across time and jurisdictions.
- Establishing a protocol for regular (e.g., yearly) surveys of jurisdictions through the use of "core" traffic-safety questions.
- Compiling surveys and survey data into an ongoing web-based "library" where qualified researchers could access tools and raw data. This would support powerful meta-analyses, provide researchers with the ability to apply research and theory against consistent data, and provide an interesting media resource.
- Combining observational data with survey data to address the issue of survey validity. For example, differences, if any, could be determined between observed and reported restraint device use within a population so that the validity of restraint device use survey data could be better understood. Similarly, differences between reported and observed crash rates, speeds, impaired driving, and the like could be examined.
- Supplementing jurisdictional crash reduction targets with those based on knowledge, attitude, and self-reported behavior data derived through surveys.
- Systematically monitoring media's response to and use of survey-derived data to better understand how these data can be used most effectively.

Clearly, these steps would require commitment, leadership, and cooperation among the participating organizations, but, from the examples of the (few) large and ongoing surveys cited, this is certainly within the realm of possibility.

Conclusion

Clearly, public surveys have a multifaceted role to play with respect to road safety. They are valuable tools with which to measure program effectiveness, deference to traffic law enforcement, knowledge, attitudes, and safety culture in general. In addition, public surveys can play an important role in improving safety culture by helping to place and sustain road safety on the

public policy map. In this sense, surveys, properly communicated, can bring about Heisenberg's Principle—where the very act of observing a phenomenon can alter it.

Public surveys of this nature, while useful and effective on many fronts, can also pose a political risk to the agencies responsible for improving road safety. For example, there may be significant political fallout if thirty percent of survey respondents report "very frequently" exceeding the posted speed limit by more than 20 km/h, but only one percent of those had received a traffic ticket within the past two years. However, a reduction in the number of people self-reporting that they exceed the posted speed limit by more than 20km/h and/or an increase in the number of those respondents reporting having received a ticket within the past two years would be an indication of success.

It is clear that many of the conventional practices in place to improve road safety have become institutionalized over time and, to lesser or greater degrees, do not benefit significantly from a solid base of contemporary empirical research. The challenge today is to reestablish the link between the practice and the desired outcome by using both conventional and alternative sources of data, such as public surveys, to determine the value and improve the effectiveness of conventional practices.

Public surveys are not a panacea for improving road safety but, carefully constructed and properly applied, they can provide value on many fronts. This is especially true if they are administered by an organization with both the credibility and capacity to legitimize and properly communicate the findings. Essentially, surveys are one of the few tools available for measuring whether or not we as a society are becoming more conscious of the risks associated with road transportation and more receptive to the measures in place to help reduce them.

References

Andreasen, A. R. 1995. *Marketing social change: Changing behavior to promote health, social development, and the environment*. San Francisco, U.S.

Canada Safety Council (CSC). 2003. *2003 Aggressive driving study: Summary of results.* Ottawa, Canada.

Emery, C. 1994. Library of Parliament. *Public opinion polling in Canada*. Ref: BP-371E. Ottawa, Canada.

European Commission (EC). 2003. Directorate-General for Energy and Transport. *Saving 20,000 lives on our roads: A shared responsibility.* Luxembourg, Belgium.

European Road Assessment Programme (EuroRAP). 2005. *From Arctic to Mediterranean, First Pan European Progress Report.* London, UK.

Insurance Institute for Highway Safety (IIHS). 2001. *Status report: What works and doesn't work to improve highway safety.* Volume 36, No. 5. Arlington, U.S.

Ipsos. 2004. *Canadians' national policy issues agenda*. Volume 19, Number 5. Toronto, Canada.

International Association of Traffic and Safety Sciences (IATSC). 2005. *White paper on traffic safety in Japan 2005*. Traffic Safety Awareness Survey. Tokyo, Japan.

Land Transport New Zealand (LTSA). 2005. *Survey of public attitudes to road safety 2004: Summary of results*. Wellington, New Zealand.

Mäkinen, Zaidel, et al. 2003. *Traffic enforcement in Europe: Effects, measures, needs and future*. Finland.

Miami Herald. 2005. The need for speed worries police, safety activists. Speed may kill, but it also sells cars. And that's why safety experts have a hard time curbing the horsepower race. Miami, U.S.

Progressive. 2004. Media Release. "A lead foot can lead to a lighter wallet." Mayfield Village, Ohio.

Social Attitudes to Road Traffic Risk in Europe (SARTRE). 1998. *The attitude and behaviour of European car drivers to road safety.* European Union.

Traffic Injury Research Foundation (TIRF). 2001, 2002. *Road safety monitor: Drinking and driving*. Ottawa, Canada.

Transport Canada. 1997. *Public perceptions of road Safety in Canada*. Ottawa, Canada.

———. 2004. *Road safety vision 2010–2002 annual report*. Ottawa, Canada.

———. 2006. *Survey of seatbelt use in Canada 2004–2005*. Ottawa, Canada.

Biographical statements

Paul Allen is a road safety researcher with more than ten years experience managing road safety programs for public and private sector agencies in British Columbia, Manitoba and Ontario. As a provincial road safety manager for the Insurance Corporation of British Columbia and Manager of Road Safety for Manitoba Public Insurance, he developed and implemented provincial and community-based programs and conducted in-depth research on the effectiveness of various speed and impaired driving initiatives. He has participated on numerous provincial and national safety committees and task forces including the task force that created Canada's "Vision 2010" and has authored and presented papers on a wide variety of road safety topics. Mr. Allen is Past-President of the Canadian Association of Road Safety Professionals (www.carsp.ca).

G. William (Bill) Mercer (Ph.D. Psychology; MA Environmental Studies) is the Director of Projects at Applied Research and Evaluation Studies at the University of British Columbia (ARES—www.ares.ubc.ca). Prior roles include Issue Manager of Impaired Driving Strategies (including the province-wide CounterAttack program) and Senior Policy Analyst in the Strategic Initiatives Department, both at the Insurance Corporation of British Columbia; Senior Policy Analyst, BC Police Commission; Research Director and Senior Analyst/Manager, Police Services Branch; Director, Drinking-Driving CounterAttack Program; and Senior Research Associate, Policy Planning Branch, all at the BC Ministry of Attorney General. He has also taught psychology at a number of universities for more than a decade.

Appendix

The following two tables are survey-question categories and examples of types of surveys.

Table 1. Examples of questions by category.

Knowledge	Attitude	Perception	Behavior	History
What are the penalties for exceeding the posted speed limit by more than 20 km/h?	Does exceeding the posted speed limit increase the chance of being involved in a crash?	What are the chances of being caught by police for exceeding the posted speed limit by 20 km/h on a highway?	How often do you exceed the posted speed limit by more than 20 km/h on a highway?	Within the last year have you received a traffic ticket for speeding?
Can a driver be pulled over and ticketed for driving under the speed limit, but too fast for conditions?	How acceptable is it to travel 120 km/h in a 100 km/h zone?	What are the chances of being caught by police for exceeding the posted speed limit by 20 km/h within town?	How often do you exceed the posted speed limit by more than 20 km/h within town?	Within the last year have you been involved in a crash?
What are penalties for speeding in highway construction zones?	Do you believe enforcing the speed limit prevents crashes?	What are the chances of having a traffic ticket overturned in court?	How likely are you to reduce your speed in a highway construction zone?	Within the last year, how may times have you witnessed police conducting traffic enforcement?

Table 2. Examples of surveys.

Organization	Title	Medium	Data				Frequency
			AP	K	B	HE	
Transport Canada	Public Perceptions of Road Safety in Canada (Transport Canada 1997)	Telephone	✓	✓	✓	✓	Infrequent
	Survey of Seatbelt Use in Canada Survey (Transport Canada 2006)	Observational			✓		Annual
Traffic Injury Research Foundation (TIRF)	Road Safety Monitor (TIRF 2001, 2002)	Telephone	✓	✓	✓		Intermittent
Land Transport, New Zealand	Survey of Public Attitudes to Road Safety (LTSA 2005)	Face-to-face	✓	✓	✓	✓	Annual
Canada Safety Council (CSC)	Aggressive Driving Survey (CSC 2003)	Telephone	✓		✓		Annual
International Associationof Traffic and Safety Sciences	Traffic Safety Awareness Survey (IATSC 2005)	Mailed Questionnaire	✓	✓			Infrequent

AP—Attitude / Perception, K—Knowledge, B—Self-reported Behavior,
HE—Collision History / Ticket Experience

A review of safety culture theory and its potential application to traffic safety

Douglas A. Wiegmann and Terry L. von Thaden

Institute of Aviation
Human Factors Division
University of Illinois at Urbana–Champaign

Alyssa Mitchell Gibbons

Department of Psychology
University of Illinois at Urbana–Champaign

Overview

Over the past several years, organizations in high-risk industries such as nuclear power and aviation have become increasingly aware of the role that safety culture plays in shaping reliable and safe operations. As a result, safety professionals working in other industries and transportation modalities such as manufacturing, construction, chemical and petroleum processing, and traffic safety have also begun contemplating the role that safety culture might play in mitigating risk within these settings. The purpose of the present chapter, therefore, is to (1) briefly review and synthesize previous safety culture literature, (2) discuss the challenges of moving beyond safety culture as simply an intuitive explanation of accidents to actual measurement and change, and (3) analyze the similarities and differences between traffic-safety systems and other high-risk industries that may impact the applicability of the safety-culture concept across these domains. The paper concludes with recommendations for future research on the topic of safety culture as applied to traffic safety.

Introduction

Why do accidents happen?

At first blush, the question “why do accidents happen” may seem simple. However, in reality the answer to this question is rather complex. Views about why accidents occur range from philosophical explanations such as the “just-world hypothesis” (i.e., that bad things happen to bad people) to more scientific explanations that seek empirical casual mechanisms (Reason 2000). Even within the scientific community, views concerning the causes of accidents vary considerably, which can greatly impact the nature of interventions employed to improve safety.

Several historians and authors note that theories of accident causation have evolved systematically over the years (e.g., Heinrich 1950; Gordon et al. 1996; Wilpert 2000). For

example, the first stage of scientific theorizing about the causes of accidents is commonly referred to as the technical period, during which developments in new mechanical systems were rapid and most accidents were viewed as being caused by mechanical malfunctions, particularly in the structural integrity and reliability of equipment (Wiegmann and Shappell 2001). The second stage is known as the period of human error, where limitations of the human operator rather than catastrophic mechanical malfunctions were identified as the source of system breakdowns, shifting the attention of safety analyses from mechanical aspects to the person directly involved in committing the error (Rochlin and Von Meier 1994; Coquelle, Cura, and Fourest 1995). The third stage is referred to as the sociotechnical period, during which the negative impact that poor ergonomics and systems design have on the interaction between humans and technical factors was often cited as a cause of errors and accidents. Finally, recent years have witnessed the development of a fourth stage, which is often called the "safety culture" period (Gordon et al. 1996; Wilpert 2000). This approach recognizes that operators are not performing their duties or interacting with technology in isolation, but rather they are performing as coordinated teams embedded within a particular organizational culture.

The beginning of the safety culture period of accident investigation and analysis can be traced back to the nuclear accident at Chernobyl in 1986 in which a "poor safety culture" was identified as a factor contributing to the accident by both the International Atomic Energy Agency and the OECD Nuclear Agency (Cox and Flin 1998; Mearns and Flin 1999; Pidgeon 1998). Since then, safety culture has been discussed in other major accident inquiries and analyses of system failures, such as the King's Cross Underground fire in London and the Piper Alpha oil platform explosion in the North Sea (Cox and Flin 1998; Pidgeon 1998), as well as the crash of Continental Express Flight 2574 (Meshkati 1997), the Columbia Space Shuttle accident (CAIB 2003), and the explosion at the British Petroleum refinery in Texas City (CSB 2005).

In general, safety culture has been found to be important across a wide variety of organizations and industries. For example, safety culture has been associated with employees' safety-related behavior in industries such as manufacturing (Cooper and Phillips 2004; Griffin and Neal 2000), shipping (Hetherington et al. 2006), chemical processing (Hofmann and Stetzer 1996), and building maintenance (Wallace and Chen in press). Safety culture also appears to predict on-the-job injury and accident rates in manufacturing firms (Varonen and Mattila 2000; Zohar 2000), offshore oil and gas companies (Mearns, Whitaker, and Flin 2003), and also in broad cross-organizational studies of workers in general (Barling, Loughlin, and Kelloway 2002; Huang et al. 2006). While initial studies of safety culture took place in jobs that have traditionally been considered high-risk, organizations in other areas are increasingly exploring how safety culture is expressed in their fields (e.g., retail: DeJoy et al. 2004). Overwhelmingly, the evidence suggests that while safety culture may not be the only determinant of safety in organizations (cf. Smith et al. 2006), it plays a substantial role in encouraging people to behave safely. Accordingly, the concept of safety culture may also prove applicable to traffic safety. While relating safety culture to the various facets of traffic safety presents unique challenges (which are discussed in detail below), the broad base of support across domains for the importance of safety culture in general suggests that it is worth considering in this context.

In the remaining portions of this chapter, we will (1) present an overview and synthesis of the safety culture and safety climate literature, (2) discuss the challenges of moving from the intuitive concept of safety culture to actual measurement and change, and (3) examine the relationship between traffic safety systems and other high-risk industries that influence the applicability of the safety culture concept across these domains.

What is safety culture?

As previously mentioned, the current interest in the term "safety culture" can be traced directly to the findings of the Chernobyl nuclear accident in 1986. Since then, numerous definitions of safety culture have abounded in the safety literature. In fact, our earlier review of the literature revealed several diverse definitions of the concept (Wiegmann, Zhang, and von Thaden 2001; Wiegmann et al. 2002). These various definitions of safety culture are presented in Table 2 in the Appendix.

While diverse, there appear to be several commonalities among these various definitions of safety culture across industries. Considering these commonalties among definitions, a global definition of safety culture can be formulated. This definition is:

> *Safety culture is the enduring value and priority placed on worker and public safety by everyone in every group at every level of an organization. It refers to the extent to which individuals and groups will commit to personal responsibility for safety, act to preserve, enhance and communicate safety concerns, strive to actively learn, adapt and modify (both individual and organizational) behavior based on lessons learned from mistakes, and be rewarded in a manner consistent with these values.*
> (Wiegmann et al. 2002).

It should be noted that the proposed definition of safety culture is stated in neutral terms. As such, the definition implies that organizational safety culture exists on a continuum and that organizations can exhibit a safety culture ranging from excellent to poor. However, not all definitions in the literature make this assumption. Some suggest that safety culture is either present or absent within an organization. Nevertheless, it is clear from the initial introduction of the term within various operational environments that safety culture is assumed to be a component of an organization that can be continually improved rather than simply instilled (e.g., IAEA 1986 as cited in Cox and Flin 1998). Obviously, such a distinction is important when it comes to both measuring and changing safety culture within an organization.

What about Safety Climate?

Although the debate over the definition of safety culture has not reached unanimous agreement, the similar term "safety climate" has been used almost interchangeably in the literature and has added to the confusion. Furthermore, our previous review of the literature (Wiegmann et al.

2001; Wiegmann et al. 2002) indicated that, from the time the term was first highlighted by Zohar (1980), the literature has not presented a generally accepted definition of safety climate either (see Table 1 in the Appendix).

As indicated in Table 2, many safety climate definitions have commonalities and differ from safety culture definitions in important ways. Therefore, based on these common themes, a general safety climate definition can also be derived:

> *Safety climate is the temporal state measure of safety culture, subject to commonalities among individual perceptions of the organization. It is therefore situationally based, refers to the perceived state of safety at a particular place at a particular time, is relatively unstable, and subject to change depending on the features of the current environment or prevailing conditions.* (Wiegmann et al. 2002)

In brief, safety culture, as defined in the literature, is commonly viewed as an enduring characteristic of an organization that is reflected in its consistent posture with critical safety issues. On the other hand, safety climate is viewed as a temporary state of an organization that is subject to change depending on the features of the specific operational or economic circumstances.

What are the indicators of an organization's safety culture?

While many different models of safety culture have been proposed, our previous research in the aviation industry (e.g., Wiegmann et al. 2002) has identified at least four essential elements or organizational indicators of safety culture. As illustrated in Figure 1, these include the organization's commitment to safety, the involvement of operational supervisors in safety-related activities, the formal safety system of the organization, and the organization's informal safety system. We review each of these briefly below.

Organizational Commitment. The *organizational commitment to safety* refers to the degree to which an organization's senior management prioritizes safety in decision-making and allocates adequate resources to safety. In particular, an organization's commitment to safety is reflected by three major components, including (1) **Safety Values**—Attitudes and values expressed (in words and actions) by upper management regarding safety, (2) **Safety Fundamentals**—Compliance with regulated aspects of safety, such as training requirements, manuals and procedures, and equipment maintenance, and (3) **Going Beyond Compliance**—Priority given to safety in the allocation of company resources (e.g., equipment, personnel time) even though they may not be required by regulations.

Operational Personnel. This factor refers to the degree to which those directly involved in the supervision of employees' safety behavior are actually committed to safety and reinforce the safety values espoused by upper management (when these values are positive). These include (1) **Supervisors/Foremen**—their involvement in and concern for safety on the part of supervi-

sory and "middle" management at an organization, (2) **Maintenance Supervision**—those who are responsible for ensuring that priority is given to safety, effectively managing, maintaining, and inspecting the safety integrity of the equipment/tools, and (3) **Trainers**—the extent to which those who provide safety training are in touch with the actual risks and issues associated with performing a particular job.

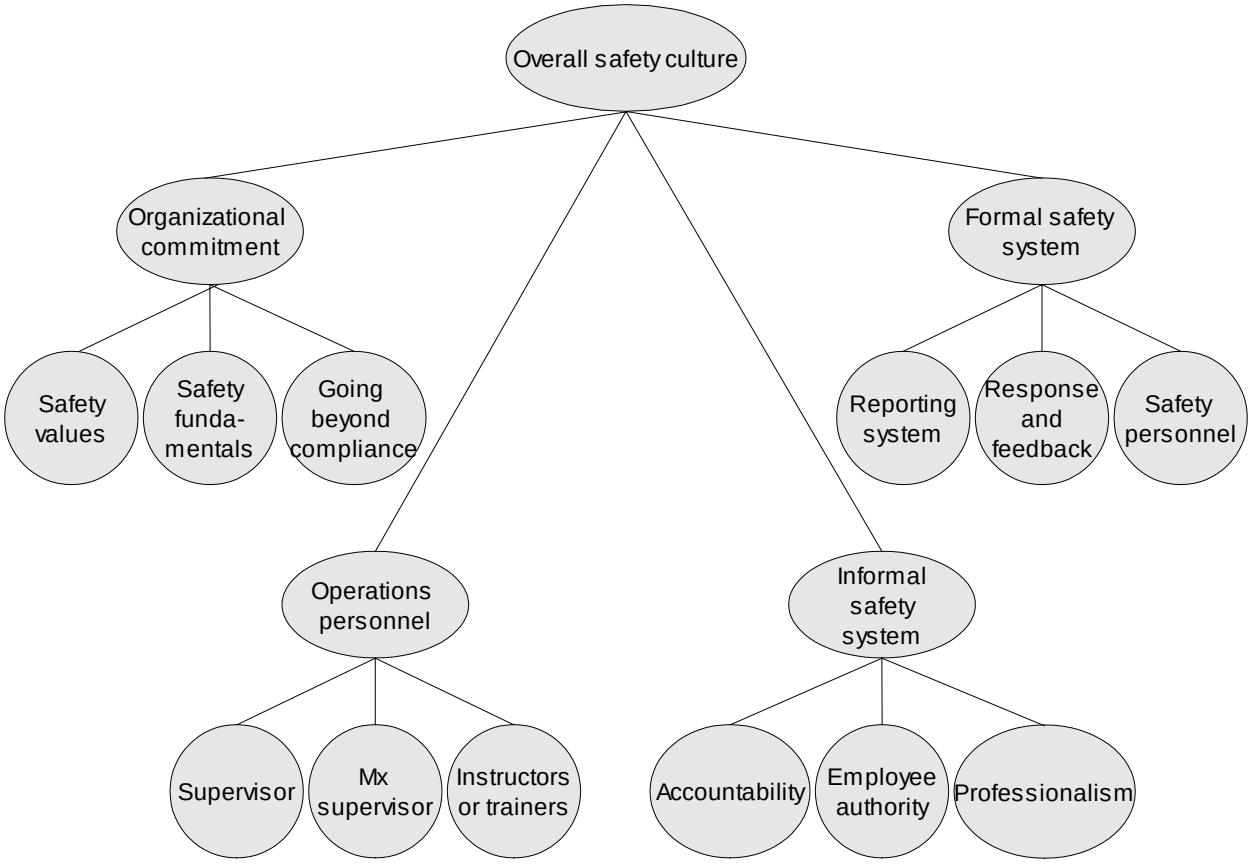

Figure 1. Organizational indicators of safety culture. Adapted from Gibbons, von Thaden, and Wiegmann (2006).

Formal Safety System. The *formal safety system* refers to the processes for reporting and addressing both occupational and process safety hazards. Such formal systems include: (1) **Reporting System**—Accessibility, familiarity, and actual use of the organization's formal safety reporting program, (2) **Feedback and Response**—Timeliness and appropriateness of management responses to reported safety information, and dissemination of safety information to workers and (3) **Safety Personnel**—Perceived effectiveness of and respect for persons in formal safety roles (e.g., Safety Officer, Vice President of Safety).

Informal Safety System—In contrast to the formal safety system, the *informal safety system* refers to the unwritten rules pertaining to safety behavior, including rewards and punishments for safe and unsafe actions and the manner in which such rewards and punishments are instituted in a just and fair manner. Specifically, the informal safety systems include such factors as

(1) **Accountability**—The consistency and appropriateness with which employees are held accountable for unsafe behavior, (2) **Authority**—Authorization and employee involvement in safety decision making, and (3) **Employee Professionalism**—Peer-culture employee-group norms pertaining to safe and unsafe behavior.

Can safety culture be changed?

The question of whether or not safety culture can be intentionally changed is difficult to answer. On one hand, the fact that safety culture has been cited as a contributing or causal factor in many accidents suggests that, at least in the minds of some safety professionals, safety culture can be changed. After all, factors are not generally cited as "causal" to accidents if they can't be manipulated or changed (Wiegmann and Shappell 2003). For example, gravity is rarely, if ever, cited as a cause of an aviation accident, even though one might argue that most aviation accidents involving collision with terrain are due to gravity. Given we cannot change gravity, it would be silly and futile to cite it as a causal factor to accidents. Therefore, in practice, citing a variable as "causal" generally implies that something can be done to change it or at least effectively mitigate its impact on safety. Consequently, it appears that to some researchers and safety professionals, safety culture is amenable to manipulation and intentional change (Wiegmann et al. 2002).

Not all researchers or practitioners, however, would agree with the assumption that (safety) culture can be intentionally manipulated (Creswell 1998). These individuals argue that, like all aspects of culture, safety culture is an emergent property of a particular society, industry, or organization, generated by its unique history and individual members (Smircich 1983). Furthermore, individuals within a culture are often unaware of the impact their culture has on their behavior. Culture often guides the activities of groups and organizations at a subconscious level. According to this perspective, therefore, people do not shape their culture; rather their culture shapes them in often unpredictable and unforeseeable ways. This is not to say, however, that cultures don't change or that all cultures are the same. Rather, culture is considered beyond direct manipulation or intentional change. The fact that one might believe a culture can be intentionally changed is in itself a reflection of the culture to which one belongs.

Debates about cultural change may never be fully resolved, and at present they remain almost entirely within the philosophical rather than the empirical realm. In particular, those who espouse the position that safety culture is directly amenable to manipulation and change have yet to provide solid empirical data supporting this conclusion. While there are a growing number of anecdotal and case studies to help bolster such claims, the number of systematic studies is frustratingly small. Even research on safety climate is limited. For example, Zohar (2002) implemented a safety training intervention for supervisors and measured the subsequent effects on safety performance in their units. Results suggested that both safety climate and rate of "microaccidents" improved. However, Cooper and Philips (2004) report mixed results from a pre- and post-test study of changes in safety climate and safety behavior. Safety climate improved following a safety intervention, but actual observed safe behavior improved very little in most cases. Part of the problem can be attributed to the manner in which safety culture and/or

safety climate are defined (as stated previously). Another related reason, however, is that the existing methods to measure safety culture and organizational change are quite diverse and somewhat unsophisticated.

How is safety culture measured?

Currently, there are no standardized or "off the shelf" tools that can be used across domains or even within a single domain to measure safety culture (Cox and Flin 1998). However, a variety of methods or tools have been proposed. These tools can be classified as either quantitative or qualitative methods.

Quantitative approaches attempt to numerically measure or score safety culture using procedures that are often highly standardized and calibrated, such as highly structured interviews, surveys and questionnaires, and Q-sorts (Wreathall 1995). In quantitative measurement strategies, organization members usually serve as respondents who react to a standard set of stimuli or questions provided by researchers (Rousseau 1990). Quantitative methods are relatively easy to use in cross-sectional comparisons, generally simple to implement in different organizations and by other researchers, and straightforward to interpret according to a common, articulated frame of reference (Wreathall 1995).

Some researchers have argued that safety culture cannot be completely understood through traditional quantitative methods, which attempt to break down a phenomenon in order to study its individual components. Rather, it is best understood using methods that effectively capture the nature or essence of the activity that is being studied (Creswell 1998; cf. Glaser and Strauss 1967; cf. Suchman 1987). Furthermore, while an organization's culture is revealed in its general patterns of attitudes and actions, the deeper structure of its culture is often not immediately interpretable by outsiders (for example, the "informal" safety system). Studying organizational culture, therefore, requires the use of qualitative methods, such as ethnographic approaches, including intensive and extensive observations and employee interviews, focus group discussions, historical information reviews, and case studies (Wreathall 1995). With qualitative measurement strategies, organization members usually serve as informants, who interact directly or indirectly with researchers, using their own terms and concepts to express their point of view (Rousseau 1990). Therefore, through qualitative measurement, intensive and in-depth information can be obtained using the focal group's own language (Schein 1991).

There is general consensus among researchers that both qualitative and quantitative methods have unique potential for assessment and theory testing. There is a benefit to combining methods to gain a comprehensive understanding of safety culture. Nonetheless, quantitative approaches, especially surveys of individuals' responses, are often more practical, in terms of time and cost-effectiveness (Wreathall 1995). Consequently, surveys and questionnaires have been widely used to assess safety culture within a variety of industries, such as nuclear power, aviation, chemical processing, construction, and manufacturing. The key in any safety-culture improvement program is to develop effective measures to evaluate the current state of a particular safety

culture, as well as to determine whether interventions have been effective in achieving the desired cultural change. Both quantitative and qualitative techniques can contribute to this goal.

Does the concept of safety culture apply to traffic safety?

Whether or not the concept of safety culture applies to traffic safety may depend upon the level of analysis that is employed. The original safety-culture concept was developed to account for the impact that a specific organization's culture has on safety-related behavior of a specific workforce. Therefore, the concept applies directly to the level of an organizational unit, which is a generally well-defined entity and clearly bounded system. Consequently, the concept should directly apply to any organization or agency that affects or interacts with traffic-safety issues, including federal and state agencies, urban-planning committees, public transportation departments, road construction companies, and the like. Internally, these organizations could draw heavily upon the rapidly growing research literature regarding safety culture in other industries to improve their own safety cultures.

In particular, the health care industry may prove to be an especially appropriate model for those involved in traffic safety. Specifically, within both health care and traffic systems, accidents occur relatively frequently but generally involve only a small number of individuals at any one time. This makes health care a better model for traffic safety than industries such as aviation or nuclear power, where accidents involve rare breaches in process safety and are often catastrophic. Second, safety culture in health care organizations must encompass both employee safety and public safety. Many studies of safety culture in industries other than aviation and nuclear power, such as manufacturing, construction, or retail, emphasize the prevention of occupational injuries but do not explore the ramifications of the organization's safety culture for the public (cf. Barling and Frone 2004; DeJoy 1996; DeJoy et al. 2004). Hence, health care and patient safety efforts may provide a better parallel for traffic safety when it comes to the application of the safety-culture concept to the general public.

The application of the safety-culture concept to traffic safety becomes much more tenuous when traffic safety culture is considered at the community or societal level. At this level, the boundaries of the system can be relatively ill defined, and members of the driving public are not employed as drivers by any organization (society). Yet different cities do appear to have distinct driving cultures, as evidenced by differences in overall accident rates (Allstate Insurance Company 2006) and road rage behaviors (Prince Market Research 2006). Many traffic safety interventions also implicitly assume the existence of a safety culture. For example, many campaigns are aimed at influencing cultural values, such as "friends don't let friends drive drunk." Others, such as traffic cameras or signs announcing that speed limits will be enforced by radar, attempt to influence drivers' perceptions of the contingencies associated with safe or unsafe behavior. Many safety culture theorists argue that these perceived contingencies are the heart of safety culture (cf. Zohar 2003). Further, many if not all of the elements that make up a

strong positive safety culture in an organization have analogs at the community level. Therefore, we will briefly consider how each organizational indicator of safety culture might apply in a community setting within the context of traffic safety culture:

As stated previously, *organizational commitment to safety* refers to the degree to which an organization's senior management values safety, prioritizes safety in decision-making, and allocates adequate resources to safety. In the community, the best analog for "senior management" in regard to traffic safety is the government (city, state, and federal). Government decision-makers are responsible for ensuring adequate safety resources, such as well-maintained roads, clear and helpful signage, and sufficient law enforcement personnel. Governments also set policies regarding safety, including training and licensure programs, as well as laws and ordinances. The true values and priorities of federal and community leaders are typically conveyed to the driving public through their actions. For example, if intersections with high accident rates are only addressed after a fatal accident, it is easy for drivers to infer that the municipality's commitment to safety is low.

In traditional organizations, *operational personnel's involvement in safety* refers to the degree to which supervisors or middle managers monitor their employees' safety behavior and reinforce the safety values espoused by upper management. However, most (nonprofessional) drivers do not have supervisors in the formal sense. There are, however, public employees who are responsible for monitoring safety and setting a positive safety example. Law enforcement, of course, is the primary "supervisor." A positive safety culture at this level might best be expressed through consistent and fair monitoring and enforcement of all safety-related behavior. Where there are gaps in enforcement, drivers are encouraged to think they can "beat the system" instead of being encouraged to be safe. Both law enforcement and public transportation personnel can set a positive example of safe behavior. Furthermore, individuals who provide driver education and training, as well as those who are responsible for testing, evaluating, and licensing drivers, serve a supervisory capacity whose behavior might also be linked to the particular safety culture within a community.

The *formal safety system* in most organizations refers to processes for reporting and addressing safety hazards. While law enforcement is part of this system in relation to traffic safety, a community with a strong positive safety culture will also ensure that there are mechanisms for reporting hazards. When there is a power outage at a specific traffic light, is it quickly restored? How many complaints must be received about a poorly maintained road before it is scheduled for repair? Many communities track accident data, but are these data put to use in a proactive fashion? While individual drivers may not be willing to file formal reports on their own "incidents" or "near misses," studies suggest that many drivers are quite willing to respond to anonymous surveys about the safety of their driving behavior (Prince Market Research 2006). A community with a strong formal safety system might engage in such surveys regularly with a view to identifying hazardous trends.

The *informal safety system* poses perhaps the greatest challenge to a culture of traffic safety. As stated previously, this system refers to the unwritten norms regarding safety in an organization—does the peer culture promote safe or unsafe behavior? What are the expectations regarding

accountability for unsafe behavior? Do individuals have authority to improve safety? Changing such norms is difficult, especially for communities in which dozens of different peer groups exist. Yet the success of many safety interventions is dependent upon such cultural change. Laws requiring specific safety behaviors are often unpopular, difficult to enact, and difficult to enforce (e.g., seat belt laws, motorcycle helmet laws). Increasing the frequency of these behaviors, therefore, often involves lengthy public awareness and education campaigns. The long-term success of many such campaigns offers hope that changing informal safety culture is possible, if not easy.

Summary and recommendations

The purpose of the present chapter was to summarize and integrate the numerous reports and studies that have been conducted to define and assesses safety culture, as well as the application of the concept of safety culture to traffic safety. While there is yet no uniform agreement concerning the topic of safety culture, there is growing consensus on its definition, relevant parameters, methods of measurement, and amenability to change. While research suggests there may be general indicators of safety culture that are universal, specialized measures must be designed for specific populations or industries. Identifying population or industry-specific indicators for traffic safety presents a larger challenge as many different types of organizations and agencies promote and facilitate traffic safety, and indicators are likely to vary accordingly. An interagency collaborative approach combining qualitative and quantitative methods may prove necessary to uncover the true nature of safety culture in traffic safety.

Given that the concept of safety culture was originally developed to describe the influence of factors within a specific organization, the concept should be directly applicable to federal, state, and local agencies. Future research should therefore focus on identifying the relevant organizational indicators of safety culture within these agencies, how to best measure traffic safety culture, and what can be done to effectively change or improve safety cultures within agencies, if required. Experience suggests that pilot testing such measures and giving employees opportunities for input often provide valuable insights. If multiple organizations of the same type are included in the focus groups and pilot studies, it becomes possible to develop a general measure of safety culture and establish benchmarks that can be used across organizations in that sector.

While the concept of safety culture has been fundamentally applied to organizations or groups, it has yet to be systematically applied to the population at large. Indeed, the application of the safety culture concept to the community or societal level may be more difficult, given the boundaries of the system are relatively ill defined. Nonetheless, there is a vast amount of anecdotal evidence that safety cultures do vary across regions within the United States (U.S.), as well as between the U.S. and other countries (e.g., European nations). In this chapter, we have provided some suggestions for how the safety culture concept may be applicable to society in general. Still, several challenges exist. Identifying specific indicators of safety culture and developing appropriate methods for assessing and initiating cultural change become substantially more complex at the community or societal level. These efforts will require significant collaborations across the U.S., as well as with other countries interested in traffic safety culture. Whether or not such efforts are successful, however, may itself depend upon the prevailing safety culture.

References

Allstate Insurance Company. 2006, May. *The 2006 Allstate America's best drivers report.* Northbrook, Illinois: Author. Retrieved on February 1, 2007 from: http://www.allstate.com/Media/NewsHeadlines/pr_2006/2006_05_24_best_drivers_report.pdf.

Barling, J., and M. R. Frone. 2004. *The psychology of workplace safety.* Washington, DC: American Psychological Association.

Barling, J., C. Loughlin, and E. Kelloway. 2002. Development and test of a model linking safety-specific transformational leadership and occupational safety. *Journal of Applied Psychology* 87 (3): 488–96.

Bureau of Air Safety Investigation (BASI). 1996. Proactively monitoring airline safety performance. *Air Safety Report.* Author: Melbourne, Australia.

Carroll, J. S. 1998. Safety culture as an ongoing process: Culture surveys as opportunities for enquiry and change. *Work & Stress* 12:272–84.

Chemical Safety and Hazard Investigation Board (CSB). 2005. *BP America refinery explosion, Texas City TX, March 23, 2005. Preliminary report.* Washington DC: Author.

Cheyne, A., S. Cox, A. Oliver, and J. M. Thomas. 1998. Modeling safety climate in the prediction of levels of safety activity. *Work and Stress* 12:255–71.

Ciavarelli, A. Jr., and R. Figlock, R. 1996. Organizational factors in aviation accidents. *Proceedings of the Ninth International Symposium on Aviation Psychology.* Columbus, OH: Department of Aviation, 1033–5.

Columbia Accident Investigation Board (CAIB). 2003. *Report of the space shuttle Columbia accident investigation.* Vol. 1. National Aeronautics and Space Administration. Washington, D.C.: Government Printing Office.

Cooper, M. D. 2000. Towards a model of safety culture. *Safety Science* 36:111–36.

Cooper, M., and R. Phillips. 2004. Exploratory analysis of the safety climate and safety behavior relationship. *Journal of Safety Research* 35 (5): 497–512.

Coquelle, J. J., B. Cura, and B. Fourest. 1995. Safety culture and quality system. *Proceedings of the International Topical Meeting on Safety Culture in Nuclear Installations*. Vienna, Austria, 193–202.

Cox, S., and T. Cox. 1991. The structure of employee attitudes to safety: A European example. *Work & Stress* 5:93–104.

Cox, S., and R. Flin. 1998. Safety culture: Philosopher's stone or man of straw? *Work & Stress* 12 (3): 189–201.

Creswell, J. W. 1998. *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.

Dedobbeleer, N., and F. Beland. 1991. A safety climate measure for construction sites. *Journal of Safety Research* 22:97–103.

DeJoy, D. M. 1996. Theoretical models of health behavior and workplace self-protective behavior. *Journal of Safety Research* 27 (2): 61–72.

DeJoy, D. M., B. S. Schaffer, M. G. Wilson, R. J. Vandenberg, and M. M. Butts. 2004. Creating safer workplaces: Assessing the determinants and role of safety climate. *Journal of Safety Research* 35 (1): 81–90.

Eiff, G. 1999. Organizational safety culture. *Proceedings of the Tenth International Symposium on Aviation Psychology.* Columbus, OH: Department of Aviation, 1–14.

Flin, R., K. Mearns, R. Gordon, and M. T. Fleming. 1998. Measuring safety climate on UK offshore oil and gas installations. *Paper presented at the SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production*. Caracas, Venezuela.

Flin, R., K. Mearns, P. O'Connor, and R. Bryden. 2000. Measuring safety climate: Identifying the common features. *Safety Science* 34, 177–92.

Gibbons, A., T. von Thaden, and D. Wiegmann. 2006. Development and initial validation of a survey for assessing safety culture within commercial flight operations. *International Journal of Aviation Psychology* 16 (2): 215–37, NJ: Lawrence Earlbaum Associates.

Glaser, B. G., and A. L. Strauss. 1967. *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.

Gordon, R., R. Flin, K. Mearns, and M. T. Fleming. 1996. Assessing the human factors causes of accidents in the offshore oil industry. *Paper presented at the Third International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production*. New Orleans, LA.

Griffin, M. A., and A. Neal. 2000. Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of Occupational Health Psychology* 5:347–58.

Helmreich, R. L., and A. C. Merritt. 1998. Organizational culture. In R. L. Helmreich and A. C. Merritt, eds. *Culture at work in aviation and medicine*. Brookfield, VT: Ashgate, 107–74 .

Heinrich, H. W. 1950. *Industrial accident prevention: A scientific approach*. 3rd edition. McGraw Hill.

Hetherington, C., J. Robbins, J. Herman, and R. Flin. 2006. *Personal values and the safety climate-safety behavior relationship*. Paper presented at the Society for Industrial Organizational Psychology, Dallas, TX. May 2006.

Hofmann, D. A., and A. Stezer. 1996. A cross-level investigation of factors influencing unsafe behaviors and accidents. *Personnel Psychology* 49:307–39.

Huang, Y. H., M. Ho, G. S. Smith, and P. Y. Chen. 2006. Safety climate and self-reported injury: Assessing the mediating role of employee safety control. *Accident Analysis & Prevention* 38 (3): 425–33.

Lee, T. 1998. Assessment of safety culture at a nuclear reprocessing plant. *Work & Stress* 12:217–37.

McDonald, N. and F. Ryan. 1992. Constraints on the development of safety culture: A preliminary analysis. *Irish Journal of Psychology* 13:273–81.

Mearns, K. J. and R. Flin. 1999. Assessing the state of organizational safety—*Culture or climate? Current Psychology: Developmental, Learning, Personality, Social* 18 (1): 5–17.

Mearns, K., R. Flin, R. Gordon, and M. Fleming. 1998. Measuring safety climate on offshore installations. *Work & Stress* 12:238–54.

Mearns, K., S. Whitaker, R. Flin, R. Gordon, and P. O'Connor. 2000. *Factoring the human into safety: Translating research into practice* (Rep. No. HSE OTO 2000 061**)**.

Mearns, K., S. M. Whitaker, and R. Flin. 2003. Safety climate, safety management practice and safety performance in offshore environments. *Safety Science* 41 (8): 641–80.

Meshkati, N. 1997. *Human performance, organizational factors and safety culture*. Paper presented on National Summit by NTSB on transportation safety. Washington, D.C. April 1997.

Minerals Council of Australia. 1999. Safety culture survey report of the Australia minerals industry. Author: Australia.

Pidgeon, N. F. 1991. Safety culture and risk management in organizations. *Journal of Cross-Cultural Psychology* 22:129–41.

Pidgeon, N. and M. Oleary. 1994. Organizational safety culture: Implications for aviation practice. In N. Johnson, N. McDonald, and R. Fuller, eds. *Aviation psychology in practice*. Brookfield, VT: Ashgate, 21–43.

Pidgeon, N. 1998. Safety culture: Key theoretical issues. *Work & Stress* 12 (3): 202–16.

———. 2001. Safety culture: Transferring theory and evidence from the major hazards industries. *Tenth Seminar on Behavioural Research in Road Safety*: London: Department of Environment, Transport, and the Regions.

Prince Market Research. 2006. In the driver's seat: 2006 AutoVantage road rage survey. Nashville: Affinion Group. April 2006. Retrieved on August 3, 2006 from: http://www.affiniongroupmedia.com/surveys/RR_Report.pdf.

Reason, J. 2000. Human error: Models and management. *BMJ* 320:768–70.

Rochlin, G. I., and A. Von Meier. 1994. Nuclear power operations: A cross-cultural perspective. *Annual Review of Energy Environment* 19:153–87.

Rousseau, D. M. 1990. Assessing organizational culture: The case for multiple methods. In B. Schneider, ed.. *Organizational climate and culture*. San Francisco, CA: Jossey-Bass, 153–92.

Schein, E. H. 1991. What is culture? In P. J. E. Frost, L. F. E. Moore, M. R. Louis, C. C. Lundberg, and J. Martin, eds. *Reframing organizational culture*. Newbury Park, CA: Sage Publications, 243–53.

Smircich, L. 1983. Concepts of culture and organizational analysis. *Administrative Science Quarterly* 28 (3): 339–58.

Smith, G. S., Y. H. Huang, M. Ho, and P. Y. Chen. 2006. The relationship between safety climate and injury rates across industries: The need to adjust for injury hazards. *Accident Analysis & Prevention* 38 (3): 556–62.

Suchman, L. 1987. *Plans and situated actions: The problem of human-machine communication*. New York, NY: Cambridge University Press.

Varonen, U., and M. Mattila. 2000. The safety climate and its relationship to safety practices, safety of the work environment and occupational accidents in eight wood-processing companies. *Accident Analysis & Prevention* 32 (6): 761–9.

von Thaden, T., D. Wiegmann, and S. Shappell. 2006. Organizational factors in aviation accidents. *International Journal of Aviation Psychology*, 16 (3): 239–55, NJ: LEA.

Wallace, J. C., and G. Chen. in press. A multilevel investigation of personality, climate, self-regulation, and performance. *Personnel Psychology.*

Wiegmann, D. A., and S. A. Shappell. 2001. Human error analysis of commercial aviation accidents: Application of the human factors analysis and classification system (HFACS). *Aviation Space and Environmental Medicine* 72 (11): 1006–16.

———. 2003. *A human error approach to aviation accident analysis: The human factors analysis and classification system*. Burlington, VT: Ashgate Publishing.

Wiegmann, D. A., H. Zhang, and T. von Thaden. 2001. *Defining and assessing safety culture in high reliability systems: An annotated bibliography.* University of Illinois Institute of Aviation Technical Report (ARL–01–12/FAA–01–4). Savoy, IL: Aviation Res. Lab.

Wiegmann, D. A., H. Zhang, T. L. von Thaden, G. Sharma, and A. A. Mitchell. 2002. *A Synthesis of Safety Culture and Safety Climate Research*. University of Illinois Aviation Research Lab Technical Report ARL-02-03/FAA-02-2.

Wilpert, B. 2000. *Organizational factors in nuclear safety.* Paper presented at the Fifth International Association for Probabilistic Safety Assessment and Management, Osaka, Japan.

Wreathall, J. 1995. Organizational culture, behavior norms, and safety. *Proceedings of the International Topical Meeting on Safety Culture in Nuclear Installations*. Vienna, Austria, 24–28.

Yule, S. J., R. Flin, and A. J. Murdy, A. J. 2001, April 27–29. Modeling managerial influence on safety climate. *Poster presented at Society for Industrial and Organizational Psychology (SIOP) Conference*. San Diego, CA.

Zohar, D. 1980. Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology* 65:96–102.

———. 2000. A group-level model of safety climate: Testing the effect of group climate on micro-accidents in manufacturing jobs. *Journal of Applied Psychology* 85:587–96.

———. 2002. Modifying supervisory practices to improve subunit safety: A leadership-based intervention model. *Journal of Applied Psychology* 87 (1): 156–63.

———. 2003. Safety climate: Conceptual and measurement issues. In J. C. Quick and L. E. Tetrick, eds. *Handbook of occupational health psychology.* Washington, DC: American Psychological Association, 123–42.

Biographical statements

Douglas Wiegmann, Ph.D. is an NIH Roadmap Scholar in the Department of Surgery at the Mayo Clinic. He is also an associate professor of Human Factors and Psychology at the University of Illinois (currently on academic leave). He received his Ph.D. in psychology in 1992 from Texas Christian University and has served as an accident investigator for the NTSB and the United States Navy. Dr. Wiegmann has officially consulted on many major accident investigations of national significance, including the crash of TWA Flight 800, the Columbia Space Shuttle accident, the August 2003 east coast blackout, and the evaluation of the process safety culture at British Petroleum's North American refineries as a result of the March 2005 explosion at Texas City. Dr. Wiegmann has published extensively on the topics of human factors and system safety, including a best-selling book entitled *A Human Error Approach to Aviation Accident Analysis: The Human Factors Analysis and Classification System.* He has twice received the Aerospace Human Factors Association's Williams E. Collins Award for outstanding publications. Other major awards include the Flight Safety Foundation's Admiral Louis de Florez Award and the Aerospace Medical Association's Harry G. Moseley Award, both for significant contributions to aviation safety. He has also received the American Psychological Association's prestigious Earl A. Alluisi Award for early career achievement in the field of Applied Experimental and Engineering psychology.

Terry L. von Thaden, Ph.D. is an assistant professor in Human Factors and Information Science at the University of Illinois. She holds an M.S. in Safety and Health/Human Factors from the University of Southern California's Institute of Safety and Systems Management, and a Ph.D. in Information Science from the University of Illinois. Her research involves methodologies for measuring the culture of safety and information behavior in high-risk, safety critical sociotechnical systems including transportation and medicine. She recently received a $300K grant from the Federal Aviation Administration to advance research in safety culture by developing an integrative model of system safety and risk management for commercial airline operations. Dr. von Thaden is a past Fellow of Zonta International, The Transportation Research Board, and the National Institute for Occupational Safety and Health, and is a member of the Phi Kappa Phi and Beta Phi Mu Honor Societies.

Appendix

Table 1. Definitions of safety climate. From Wiegmann et al. (2002).

Source/Industry	Definitions
(BASI 1996) Civil aviation—Australia	The procedures and rules governing safety within an organization are a reflection of its safety climate, which is centered around employees perceptions of the importance of safety and how it is maintained within the workplace.
(Cheyne, Cox, Oliver, and Thomas 1998) Manufacturing—UK and France	Safety climate can be viewed as a temporal state measure of culture, which is reflected in the shared perceptions of the organization at a discrete point in time.
(Dedobbeleer and Beland 1991) Construction—US	Safety climate is viewed as an individual attribute, which is composed of two factors: management's commitment to safety and workers' involvement in safety.
(Flin, Mearns, Gordon, and Fleming 1998) Offshore oil and gas—UK	Safety Climate refers to the perceived state of safety of a particular place at a particular time. It is, therefore, relatively unstable and subject to change depending on features of the operating environment.
(Flin, Mearns, O'Connor, and Bryden 2000) Review of various industries (only one aviation related study)	Safety climate is the surface features of the safety culture discerned from the workforce's attitudes and perceptions at a given point in time.
(Griffin and Neal 2000) Manufacturing and Mining Australia	Safety climate should be conceptualized as a higher-order factor comprised of more specific first-order factors. First-order factors of safety climate should reflect perceptions of safety-related policies, procedures, and rewards. The higher order factor of safety climate should reflect the extent to which employees believe that safety is valued within the organization.
(Hofmann and Stezer 1996) Utilities—US)	Safety climate is operationalized as perceptions regarding management's commitment to safety and worker involvement in safety-related activities.
(Mearns, Whitaker, Flin, Gordon, and O'Connor 2000) Offshore oil—UK	Safety climate is defined as a "snapshot" of employees' perceptions of the current environment or prevailing conditions which impact upon safety.
(Minerals Council of Australia 1999) Minerals—Australia	Safety climate refers to the more intangible issues in the company, such as perceptions of safety systems, job factors, and individual factors.
(Yule, Flin, and Murdy 2001) Conventional power—UK	Safety climate is defined as the product of employee perception and attitudes about the current state of safety initiatives at their place of work.
(Zohar 1980) Manufacturing, including metal, food, chemical, and textile—Israel	Safety climate is a particular type of organizational climate, which reflects employees' perceptions about the relative importance of safe conduct in their occupational behavior. It can vary from highly positive to a neutral level, and its average level reflects the safety climate in a given company.
(Zohar 2000) Manufacturing—Israel	Group level safety climate refers to shared perceptions among group members with regard to supervisory practices.

Table 2. Definitions of Safety Culture. From Wiegmann et al. (2002).

Source/Industry	Definitions
(Carroll 1998) Nuclear power—US	Safety culture refers to a high value (priority) placed on worker safety and public (nuclear) safety by everyone in every group and at every level of the plant. It also refers to expectations that people will act to preserve and enhance safety, take personal responsibility for safety, and be rewarded consistent with these values.
(Ciavarelli and Figlock 1996) Naval aviation—US	Safety culture is defined as the shared values, beliefs, assumptions, and norms which may govern organizational decision making, as well as individual and group attitudes about safety.
(Cooper 2000) Theoretical	Safety culture is a subfacet of organizational culture, which is thought to affect member's attitudes and behavior in relation to an organization's ongoing health and safety performance.
(Cox and Cox 1991) Industrial gases—European	Safety culture reflects attitudes, beliefs, perceptions, and values that employees share in relation to safety.
(Cox and Flin 1998) Theoretical (Lee 1998) Nuclear reprocessing—UK (Wilpert 2000) Theoretical in context of nuclear power	The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management.
(Eiff 1999) Aviation—US	A safety culture exists within an organization where each individual employee, regardless of their position, assumes an active role in error prevention and that role is supported by the organization.
(Flin, Mearns, Gordon, and Fleming 1998) Offshore oil and gas—UK	Safety Culture refers to entrenched attitudes and opinions which a group of people share with respect to safety. It is more stable [than safety climate] and resistant to change.
(Helmreich and Merritt 1998) Aviation—US	Safety culture (p 133): a group of individuals guided in their behavior by their joint belief in the importance of safety, and their shared understanding that every member willingly upholds the group's safety norms and will support other members to that common end.
(McDonald and Ryan 1992) Theoretical in context of road transportation (Mearns and Flin 1999) Theoretical (Pidgeon 1991) Theoretical (Pidgeon and Oleary 1994) Theoretical in context of aviation	Safety culture is defined as the set of beliefs, norms, attitudes, roles, and social and technical practices that are concerned with minimizing the exposure of employees, managers, customers, and members of the public to conditions considered dangerous or injurious.
(Mearns, Flin, Gordon, and Fleming 1998) Offshore oil and gas—UK	Safety culture is defined as the attitudes, values, norms and beliefs which a particular group of people share with respect to risk and safety.
(Meshkati 1997) Transportation industry—US	Safety culture is defined as that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance.
(Minerals Council of Australia 1999) Mineral industry—Australia	Safety culture refers to the formal safety issues in the company, dealing with perceptions of management, supervision, management systems, and perceptions of the organization.
(Pidgeon 2001) Theoretical in context of driver behavior	A safety culture is in turn the set of assumptions, and their associated practices, which permit beliefs about danger and safety to be constructed.

Moving America towards evidence-based approaches to traffic safety

Deborah C. Girasek

Overview

Deaths and injuries resulting from motor vehicles receive relatively little attention and few resources in the United States. For example, while the NIH boasts institutes that focus on kidney diseases, hearing disorders, and dental research, no institute is dedicated to the leading cause of death for Americans aged 1 to 45: injuries. Motor vehicle crashes contribute the lion's share of these fatalities (National Center for Injury Prevention and Control 2006). In recent years, the World Health Organization, the Centers for Disease Control and Prevention, and the AAA Foundation for Traffic Safety have all contributed to efforts aimed at raising the profile of traffic safety in the minds of policy makers and the lay public.

Still it is relatively rare that public voices are raised out of concern for traffic safety, and when they are, they usually call for increased punishment of "guilty" drivers or for awareness campaigns that are not based upon any scientific foundation. What has led to this state of affairs? Some suggestions can be found in bodies of scientific literature that may be unfamiliar to the traffic safety community. This article will summarize some of these findings and propose how they might be applied to advancing traffic safety promotion.

Introduction

What are the public's current views on the causes and solutions of the risks posed by motor vehicles?

For much of the recent past, injury prevention experts worried that the word "accident" was contributing to the field's societal neglect and underfunding (Girasek 1999). Employees of the National Highway Traffic Safety Administration (NHTSA) were even banned from using the word because their leadership had concluded that it reinforced public misconceptions: that accidents "just happened" and weren't amenable to prevention (NHTSA 1997). We now have data on this subject, however, from investigators in multiple countries (Duan 2004; Eichelberger et al. 1990; Hu et al. 1996; Girasek 1999, 2001; Hooper, Coggan, and Adams 2003; Vincenten et al. 2005). They report that most people believe injuries—even those described as "accidental"—to be largely preventable. It may even turn out that the public's perception that they can control accidents underpins, in part, society's *lack* of attention to motor vehicle crash deaths (Girasek 2006).

When 585 Swedish risk assessment experts were asked to list risks that were "neglected" in society, road traffic emerged very high on their list (Sjöberg et al. 2005). Conversely, when children and adolescents were polled about 80 possible fears, "driving in a car" was among six items the authors deleted from analysis because such a high proportion (90+%) of respondents

reported "no fear" of them (Ollendick et al. 1989). This is ironic, because motor vehicle crashes are the leading cause of death for this age group.

In a study of adults living in South Carolina, 84% of respondents rated "cancer" as very serious, and 64% rated cardiovascular disease as "serious," but only 39% rated "serious car accidents" as serious—despite the fact that these crash events were labeled "serious" by investigators (Glik et al. 1999). When health care providers and community leaders in Switzerland were asked to prioritize health problems in their canton, they ranked "injuries due to road accidents" tenth (Schopper et al. 2000). Psychometric investigators have speculated that, "there are only so many things people can worry about," so they ignore the life-threatening events that have near-zero probabilities (Slovic, Fischoff, and Lichtenstein 2001a).

While a plurality of U.S. adults know that "car accidents" are a leading cause of death, 27% believe that "research that funds new ways to prevent injuries, such as devices to improve car safety…" would not be an effective use of taxpayer dollars (Research!America 2005). In a study conducted two decades earlier, a majority of respondents felt that allocating additional government funds to injury control would yield "no benefit" (Jones-Lee et al. 1985). Their reasoning might stem, perhaps, from the second-most common cause of injury cited by respondents in Research!America's survey: "carelessness and stupidity."

When another group of researchers asked eighteen subjects to comment on home injury scenarios, the cause they offered most often was "careless/stupid/inattentive/clumsy" behavior on the part of the injury victim (Torrel and Bremberg 1995). Only a quarter of their explanations cited any environmental factors. When responsibility was brought up, study participants characterized the injured person as "having chosen to expose themselves to risks in conflict with superior wisdom." The authors pointed out that such attitudes do not lend themselves to "systematic prevention efforts." The perceived association between injury and stupidity has been observed in both lay and professional communications (Girasek 2000). Even scientific reports on injury control contain pejorative language. A quick Medline search combining "injury" and "careless," for example, yielded more than 50 articles.

Roberts and Coggan (1994) lament this state of affairs in their analysis of how child pedestrian injuries have been historically framed. They point out that when responsibility for such occurrences are "located" with the child, preventive resources get directed towards educational programs aimed at changing children's behavior. Structural contributors to the problem are "ignored," and injury rates are unlikely to decline. Similarly, McCarthy (1996) has noted, "Much of the literature on child cycling accidents appear to blame the child as a victim, as though children's activities of playing and traveling were somehow wrong and that children are at fault when an adult drives a car over them."

Why is the current state of affairs problematic?

When a public health problem is perceived as something that victims bring upon themselves, it and they can suffer various forms of discrimination. The Global Lung Cancer Coalition (2003), for example, has tried to call attention to the fact that "their" disease claims more lives than breast, prostate, or colon cancer combined. They are hampered in their efforts, however, by public perceptions that lung cancer is "self-inflicted by smoking." This stigma impacts victims' self-perceptions, their families, their access to care, social support, financial resources, lung

cancer's media coverage, and the funding that governments around the world allocate to fighting the disease (Chapple, Ziebland, and McPherson 2004).

Social psychologists have found that victims of preventable disease are rated less favorably than people suffering from diseases perceived to be unpreventable (Sloan and Gruman 1983). In an experiment designed specifically to explore the association between perceived controllability and stigma, Weiner and colleagues (1988) asked subjects to react to two people with paraplegia. Study participants were told either that the person's injury was caused by "negligently" colliding with the rear of someone else's car, or that he was injured when another driver collided with the rear of his car. Respondents were significantly more likely to attribute responsibility and blame under the first condition; but they were also more likely to express anger towards that person, decreased "liking," decreased pity, and less willingness to provide him with assistance and charitable donations. Other investigators have reported that subjects are less inclined to pay for programs that prevent deaths which victims could have acted to avoid (Mendeloff and Kaplan 1989; Beggs 1984).

In a national random digit dial (RDD) telephone survey, US adults were asked what proportion of motor vehicle crash deaths they thought could be prevented. Their mean response was 62% (Girasek 2001). When asked "Which type of accidental death do you think the public might be more likely to blame on the person who was injured?" 60% of respondents cited those due to motor vehicle crashes (versus 11% each for poisoning and fires/burns, 7% drowning, 6% don't know, and 5% falls). It seems logical that diminished sympathy for the victims of a health problem could translate into diminished support for reducing their numbers, diminished support for alleviating their suffering, and reduced identification for being "at risk."

One reason that members of the public are most likely to "blame" motor vehicle crash injuries on victims may be that they exaggerate the contribution of alcohol to such deaths (Girasek, Gielen, and Smith 2002). While this misperception may not strike safety advocates as problematic, it could be if it increases driver perceptions that they are less likely than others to be involved in a car accident (see "Assess possible unintended consequences" below).

This view is also unlikely to translate into support for evidence-based drunk-driving interventions, since public levels of awareness of intervention effectiveness are low. US adults are evenly divided, for example, over whether increasing the legal drinking age to 21 has saved any lives. In reality, this legislation has been studied exhaustively and is well documented as having reduced both traffic crashes and fatalities (Wagenaar and Farrell 1988; US General Accounting Office 1987; NHTSA 2000). Similarly, four out of five survey participants did not believe that "increasing the price of alcohol beverages by raising taxes on them" would reduce drinking and accidental deaths (Girasek, Gielen, and Smith 2002). Again, the public either does not know or doesn't believe that credible evidence supports this prevention strategy.

In the national RDD study referred to above, subjects were asked to name the most effective thing that the US could do to reduce the number of people who die in motor vehicle crashes. Most of their recommendations (39%) involved changing a law or regulation. The accident scenarios they provided suggested that they were attempting to reduce drunk/drugged driving (25%) and speeding (20%). Only 8% of subjects raised vehicle design improvements, and many fewer mentioned road modifications (Girasek and Gielen 2003).

The public generally supports public-awareness campaigns (NHTSA 1999b), much to the chagrin of traffic safety experts who know that education is rarely effective when applied in isolation. In the realm of environmental protection, it has been shown that policy makers' views mirror the public's more so than "experts" (Sjöberg et al. 2005).

Most U.S. drivers are content with current levels of police enforcement (NHTSA 1999b), despite the fact that traffic safety has been described as "subordinate" among the police community's mandates (Lonero, Clinton, and Sleet 2006). This does not make epidemiological sense, in that traffic crashes kill far more people than homicides or drug use. It may reflect the public's view of the police department's role in society, however, and their perception of what constitutes criminal behavior.

Factors contributing to current views

Fundamental attribution error

Social psychologists have observed a number of tendencies, often referred to as "biases," that systematically distort people's perceptions (Hewstone 1996). The Fundamental Attribution Error refers to observers' tendency to exaggerate dispositional, or personality-based, explanations for other people's behavior while underestimating the influence of environmental forces (Wikipedia 2006). Of interest is the fact that people are much more likely to consider contextual influences when they judge their own shortcomings. This bias would favor blaming motor vehicle crash victims for their predicaments. If we were involved in a crash, however, we would be more likely to attribute the cause to other drivers or road conditions.

Just world hypothesis

Social psychologists have also posited a "Just World Hypothesis." Proponents of this phenomenon, first attributed to Lerner and colleagues, point to evidence that we often interpret our observations in a manner that is consistent with the belief that "people get what they deserve and deserve what they get" (Sloan and Gruman 1983). Blaming misfortune on victims, or derogating them such that their punishment seems deserved, are two mechanisms people use to restore their "just world" view. This bias has been ascribed to observers' interpretations of injury-producing events (Torrell and Bremberg 1995).

It is easy to envision the psychological "cover" that is provided by images of at-risk populations who are inferior and incompetent. This may explain, in part, why the Darwin Awards (Northcutt 2000) was on the *New York Times* bestseller list for six months. Based upon the popular website, this book—which contains confirmed stories of fatal injury events—claims to "commemorate

those individuals who ensure the long-term survival of our species by removing themselves from the gene pool in a sublimely idiotic fashion."

Optimistic bias

More than one hundred studies have now confirmed that people consistently overestimate their probability of experiencing positive life events and underestimate their likelihood of experiencing negative life events (Taylor and Brown 1994; Weinstein 1982). Numerous investigators have shown this bias to apply to perceptions of motor vehicle crash risk (e.g., DeJoy 1989; DeJoy 1992; Harré, Foster, and O'Neill 2005). This phenomenon may not be as pronounced in other countries, where people outside of automobiles are generally at higher risk than automobile occupants (Hayakawa et al. 2000).

Exaggerated views of driving prowess

Investigators who have tried to explore the basis for optimistic bias have found it to be closely linked to individual perceptions of personal control (Harris 1996; DeJoy 1989). Risks that are perceived as being under the individual's control are the most likely to evoke unrealistic optimism (Cleary 1987). So, for example, people judge their chances of being in a car accident to be below average when they imagine driving the vehicle in question, but not when are assigned the role of passenger (McKenna 1993). When given the opportunity to justify such judgments, subjects generally report that they possess superior skills for carrying out the hazardous task (Greening and Chandler 1997).

If such conclusions were well founded, they would not merit our concern. Unfortunately, they are not based upon reality. It has been shown repeatedly that the overwhelming majority of drivers consider their skills to be above average (Greening and Chandler 1997; DeJoy 1999a), which defies simple arithmetic. A correspondingly small proportion of automobile operators rate their driving skills as "below average." Even people who have been involved in auto accidents report superior driving skills (McKenna and Albery 2001). It has also been shown that people who overrate their driving skills think that traffic safety messages are aimed at others (Walton and McKeown 2001).

Gender-related variations in risk perceptions

Of interest is the fact that in at least one study, males underestimated their risk of being involved in car accident *even when they were passengers* in the vehicles in question (Greening and Chandler 1997). When driving skills are relevant to the scenario under discussion, males are also more likely than females to exhibit optimistic bias (DeJoy 1992). Generally, men judge hazardous products to be less dangerous than females do, they perceive less risk in using hazardous products without protective equipment, and they express more confidence in their ability to use such products than females do (DeJoy 1999a). Males rate dangerous driving behaviors as less likely to

lead to accidents, and they are less likely than females to rate accidents as being "serious" (DeJoy 1992; Glik et al. 1999; McEvoy, Stevenson, and Woodward 2006).

This gender effect seems to start at an early age, since even 6- to 10-year-old boys rate drawings of risky playground activities as significantly less dangerous than their female peers (Morrongiello and Rennie 1998). Fifty-seven percent of boys felt that they were less likely to be injured than their peers, versus 36% of girls. By age 10, however, 69% of the sample overall demonstrated optimistic bias with regard to injuries.

Contributions of political ideology

Western cultures, like the United States, tend to emphasize individualism over collectivism. This may lead our citizens to view both the cause and solution of social problems, like traffic safety, in terms of individuals (e.g., buy a big car to protect your family rather than organize community members to relocate trees away from the roadside).

Citizens who self-identify as political conservatives may be particularly quick to frame issues in terms of personal responsibility. For example, studies have shown that political conservatives are more likely than "liberals" to endorse the following viewpoint:

> *If people want to enjoy the benefits of society, then they should behave responsibly; if not, they should accept the natural consequences of their actions* (Skitka and Tetlock 1993).

This may translate into less concern for at-risk drivers, and less support for programs that are perceived as protecting them. Conservatives have been shown to be less willing to help people whom they believe to be responsible for their own plight, "even in life and death settings" (Skitka and Tetlock 1993). Under conditions of scarcity, liberal patterns of allocation are more likely to approximate those of conservatives.

Delineating where personal responsibility for safety ends, and government responsibility begins, has been acknowledged as challenging (Weinstein 1987). It is a value-laden decision that is driven, in part, by political ideology. Sylvia Noble Tesh (1988) has pointed out that when a problem, like injuries, is considered using individuals as the basic unit of analysis; politically conservative predispositions are favored; as are remedies that rely on health education (versus structural change).

The appeal of education-only approaches

The belief that traffic deaths can be reduced through simple public-awareness campaigns has been described as "widespread," "incorrect," and a great hindrance to road safety campaigns (Lonero, Clinton, and Sleet 2006).

David Stone (1989) had gone as far as claiming that prevention programs receive official support in inverse relation to their probable effectiveness. Here is his explanation for this state of affairs:

> *Socioenvironmental change is costly, radical and unpredictable, and therefore to be avoided, while health education is cheap, generally uncontroversial and safe: if it works, the politicians take credit, and if it does not, the target population takes the blame for not responding.*

While Dr. Stone's analysis may strike some as cynical, in the traffic safety arena his claim that education is politically safe and noncontroversial rings true. It appeals to the American values of personal freedom and individual responsibility. Vogel (1991) has noted that government exercise of paternalism is particularly likely to be judged "illegitimate" in the United States.

Traffic crashes lack outrage-evoking characteristics

In contrast to traffic safety experts who wonder why the lay public does not get more exorcised about the death toll on our roads, executives from the chemical and energy industries feel wrongfully maligned when community activists raise concerns about injuries they view as hypothetical or statistically insignificant. In the 1980s, researchers began to identify characteristics of potential threats that were associated with high levels of public ire. Peter Sandman (1987) calls these qualities "outrage factors—everything that is relevant about a risk except how likely it is to be harmful."

Many investigators have contributed to the body of literature that describes these components. I will summarize the major ones here because they suggest why motor vehicle crashes don't typically generate high levels of community concern.

Risks that are assumed *voluntarily* are associated with less outrage. Risks that are associated with *familiar* products or surroundings are less alarming than novel, exotic threats. Hazards which produce "*dreaded*" outcomes produce more outrage. [We know that death from cancer is more dreaded than dying in a car crash because people will pay three times more to prevent the former than the latter (Jones-Lee, Hammerton, and Philips 1985).] *Fatalities that cluster,* in time or space (e.g., plane crashes), get much more attention than one-off deaths. Threats that are *observable* (versus invisible), and have immediate effects (e.g., unlike radiation), are less concerning (Slovic, Fischoff, and Lichtenstein 2001b). Life-threatening hazards that are *under the control of the individual-at-risk* generate less outrage than those we rely on the government or corporate sector to shield us from.

We have already discussed the degree to which drivers think they control their crash involvement. If we could convince them that their traffic risk is a function of the roads they must travel or the vehicles available to them for purchase, as well as the legal jurisdictions they inhabit, they might be much more likely to demand government action. Working against motor vehicles'

perceived risks are their *high level of perceived benefits*. Slovic and colleagues (2001b) have identified benefits as another quality that is inversely related with levels of public concern.

Scientists don't communicate well with the lay public

As illustrated above, the public is often unaware of scientific advances in the safety arena. This is not surprising because academics typically have little incentive and few skills for communicating with the media. Journalists may also find it challenging to explain complex policy studies in the short time they have the public's attention. Stories on legislative evaluations lack the popular appeal of "medical breakthroughs." Importantly, scientists may also feel that their job is done once they have communicated with their professional peers. Whose job is it to tell the public which safety interventions "work?" And whose job is it to "sell" successful interventions so that their benefits reach a wider population? This paper cannot answer these "Who" queries, since they rest on questions of political will and perceived responsibilities. We humbly propose an answer to the "How" question, however, in the section that follows.

A research agenda for moving America towards more evidence-based approaches

Set a master agenda of proven prevention methods

The first step that should taken in redirecting traffic safety research efforts around the psychosocial factors discussed in this paper is for leaders in the field to prioritize interventions based upon their proven potential for saving lives. This process could be preceded by a ranking of contributors to the highway death toll, but it must move beyond labeling "drunk driving" or "restraint use" or "speeding" as the problem. Rigorous reviews of the state-of-our-art, such as those conducted by the Cochrane Injuries Group, available at the following URL, (http://www.cochrane-injuries.lshtm.ac.uk/whatdoes.htm), must be consulted so that the science of the prevention strategies that are selected for promotion is beyond repute. While the team that makes the final determination should restrict their review to evidence-based interventions, they should be expansive in identifying interventions. For example, a study of variations in trauma care found that mortality following severe head injury was reduced by 50+% when patients received care in centers with aggressive medical management (Bulger et al. 2002). Such (i.e., tertiary prevention) strategies should be considered, along with sociopolitical changes and engineering innovations.

Once three to five priority goals have been identified, the beliefs and attitudes discussed in the "Factors contributing to current views" Section of this paper could be measured in relation to them. This process would generate a list of independent variables that are associated with opposition to the desired safety change. This step is important because the findings outlined in this article—while admittedly thought-provoking—were frequently drawn from small samples of undergraduate students who participated in experiments with unknown relevance to the real world of traffic safety advocacy. We should study the views of policy makers, as well as their constituents. Science has been described as "just one of the many ingredients" that drives lawmaking (Shaw and Ogollo 2006). We must learn how to measure and manipulate the other ingredients in play. Such work must be collaborative and cross disciplinary (e.g., public health experts engaged with political scientists).

Evaluate efforts to change problematic attitudes, beliefs, and biases

Reframing the problem

Once we determine which attitudes/beliefs/biases are associated with opposition to the evidence-based method we are promoting, we could compare means of modifying them. McKenna and Myers (1997) have shown, for example, that when subjects are told that their driving ability will be judged objectively, they tend to tone down their self-reports of superior ability. Opportunities for applying this lesson under real world conditions, however, are not obvious. Rather than trying to convince people that their estimations of driving prowess are exaggerated, some success has been achieved by illustrating the limited "protection" that accrues to "good drivers" (Chandler et al. 1999). We could try to heighten their awareness of all the times that they, or their loved ones, are on the road without the perceived protection of their superior driving skills (e.g., when they are in cabs, car pools, airport shuttles). These experiments should definitely explore risk perceptions that are based upon *environmental* characteristics. Residents might be informed, for example, that the stretch of road on their child's bus route carries an increased risk of death versus that in the neighboring locale (which has been modernized). Similar comparisons, based upon policy advantages, could also be publicized.

In trying to move the public towards evidence-based solutions, we might study the effect of reminding citizens that they share the road with people who represent the range of human experience: some are mentally challenged, some are teenagers, some are grieving, some are elderly, some are going through a divorce, some can't read, others are taking medications that make them drowsy, and many are running late. By self-report, drivers admit engaging in a distracting activity once every six minutes (McEvoy, Stevenson, and Woodward 2006). Our systems should be designed to accommodate this mix of vehicle operators, not some population of ideal automatons (Mohan 2000; Baker 2000).

Torrell and Bremberg (1995) have called for marketing injuries "not as expressions of deviant behavior—but rather as a consistent result of the highly complex reality" that occasionally overwhelms us. They call for "systematic efforts to widen the acceptance of variation in human behavior." This approach might temper the victim-blaming noted earlier. All attempts to modify beliefs, however, should be driven by previous work which demonstrates that those beliefs are problematic in relation to the evidence-based strategy being targeted for advancement.

In contrast to experiments aimed at changing audience beliefs, investigators could attempt to reframe the target intervention so that it is perceived as more compatible with the audience's existing views. Social judgment theory would support this tactic (Perloff 1993). It is often used by politicians, to convince heterogeneous constituencies that they share similar positions on issues. For example, to remove the discussion of traffic safety from the moral (i.e., blame assigning) arena, perhaps we can increase its identification with the health versus law enforcement domain. It has been hypothesized that minimizing the government's role in safety promotion reduces the likelihood that libertarian reactions will be triggered (Shaw and Ogollo 2006).

Since the public does not generally feel vulnerable when considering the risks of motor vehicle travel, it may serve our cause to design campaigns that are less centered around physical danger. At least one study, for example, has shown that respondent's perceptions of legal constraints explained 35% of variance in their driving risk behaviors, while accident concerns explained just 2% of their self-reported performance (McKenna and Horswill 2006). This is consistent with the dramatic increases seen in compliance with safety recommendations after legislation is passed, despite the fact that the risk inherent in driving or riding without a restraint or helmet have not changed. When compared with six other factors that could influence speeding for example, McKenna and Horswill found that accident concerns proved to be the weakest predictor of respondents' risk behaviors. The most common reason that people speed is that they are running behind schedule (NHTSA 1999a). Perhaps we need to promote alternatives for remedying that dilemma, rather than lecturing them on the necessity of reducing a health risk that they do not perceive. Similarly, if increasing public transit use had been set as an injury prevention goal, environmental protection gains (or cost savings) might be stressed over safety benefits.

These examples illustrate the value of querying our target audience prior to designing communications campaigns, so that initiatives can complement existing perceptions and emphasize benefits that are important to them.

Other considerations

Incorporate factors relevant to dissemination into study designs

Any research that is designed to address the concerns raised in this paper should be rigorous, but it should also be practical. In determining how to increase the public's acceptance of, or demand for, evidence-based traffic safety interventions, investigators should measure elements that would

help nonacademics replicate their efforts. For example, in developing communications, input should be gathered from gatekeepers and opinion leaders whose cooperation would be needed to disseminate the campaign widely. Reports should include a summary of what resources the program required. Program planners should monitor which avenues of outreach were most effective. All of this will increase the chances that promising results will reach beyond scientific circles, which is where they must go if they are to have an impact on road-related injuries.

Assess possible unintended consequences

Though most safety professionals are not physicians, they would still subscribe to the dictum: First do no harm. It is incumbent upon responsible safety professionals to assess whether our interventions have hurt the populations we had hoped to protect. Would shattering the illusions of superiority that are apparently held by most drivers cause people to drive more safely… or more nervously? Of course that would not be our intention, but self-serving biases have been associated with psychological benefits (Taylor and Brown 1994). This may be why they are difficult to modify (Greening and Chandler 1997).

A number of traffic safety innovations have introduced new hazards that were not originally anticipated (Lonero, Clinton, and Sleet 2006). This can be true of social interventions, as well as technological ones. For example, if we increase the public's appreciation of passive protection measures, will we decrease their compliance with individual safety recommendations? The results of at least two studies suggest that media interventions can backfire because they cause viewers to perceive "others" as the at-risk population for accidents (Naisbett 1961; Harré, Foster, and O'Neill 2005). We must avoid creating stereotypical images of victims because people who perceive risk groups in this manner are more likely to exhibit optimistic bias (Weinstein 1980; DeJoy 1989).

Identify champions and guardians for new approaches

It is emblematic of the issues we have been discussing that there is no obvious interest group to take on these challenges. A permanent consortium should be created to champion evidence-based traffic safety initiatives. Many players who are committed to this field (i.e., employees of public agencies and nonprofit organizations) are constrained in their abilities to influence policy debates. So those groups that *can* advance such agendas must redouble their efforts. A directory of pro-safety legislators might also be maintained to share across issues.

When safety laws are opposed or repealed, it is almost never because a majority of citizens did not support their passage. Most often, the legislation's opponents were simply organized and vocal. Traffic safety lacks a body of paid professionals to plan and sustain such efforts, sharing lessons learned as the battle is refought in a new state or nation. Too often, surviving family members struggle in isolation to correct the conditions that led to their loved one's death (Girasek 2005).

We need to be expansive and creative in identifying allies for this work. For example, traffic-calming measures might be supported by cycling enthusiasts as well as PTA members. Similarly,

groups that bear the 89 million dollar cost of motor vehicle injuries each year should be approached about collaborating on a preventive agenda (Corso et al. 2006).

Learn from our failures and critics

Movement in the history of traffic safety has not always been forward. We should analyze instances of backsliding to understand how to sustain future safety strides. Take the case of motorcycle helmet laws, an intervention that is well-documented as reducing deaths, disability, and economic losses (Insurance Institute for Highway Safety 2006). In 1975, all but three states in the US had laws mandating helmets for all motorcyclists. Today, only twenty states can boast such legislation. It is sadly predictable, therefore, that the recent increases seen in the United States' rate of traffic fatalities have been attributed to a 50% increase in motorcycle-related injuries (Centers for Disease Control and Prevention 2006).

Readers of this article are now armed with many hypotheses that might explain this state of affairs. Are motorcycle riders not deemed worthy of protection because they are perceived as putting themselves at risk? In the states that have repealed universal laws, have communities decided to embrace political ideology over solid science? We can test these questions. Scientists could be studying the social factors that are at play around the erosion of motorcycle-helmet legislation, and the degree to which they are subject to modification.

There have been some thoughtful attempts to characterize the challenges that public health policy initiatives encounter (Carey and colleagues 1994; Vogel 1991). Speaking at Johns Hopkins Summer Institute for Injury Prevention (Wallack 1997), Dr. Lawrence Wallack advised safety advocates to be prepared to defend their policy's "effectiveness, affordability, practicality, legality and fairness." Such analyses should be consulted before we attempt to bring about policy change because they allow us to launch our campaigns with ready answers to our challengers. They suggest data that will have to be collected in an objective manner, to establish whether the unintentional outcomes that our opponents feared ever came to pass. The results of such evaluations would prove valuable to advocates in other states and other countries because experience shows that the same obstacles tend to be encountered across jurisdictions and safety issues.

Conclusions

As Americans take to their cars every day, they are generally free of safety concerns. A number of biases bolster their sense of invulnerability, not the least of which is their conviction that they possess superior driving skills. In order to raise levels of concern about the public health problem that traffic injuries represent, we need to crack through their psychological armor. This may be possible by illustrating the times and ways in which they do not control their safety on the road.

We should also experiment with campaigns that portray motor vehicle injuries as the product of uncrashworthy vehicles, outdated civil engineering or lax public policies. This should set the stage for increased acceptance of evidence-based prevention methods. It may also create a

demand for more attention to traffic safety. A long-term approach to this work will be required, since we are taking on prevalent social norms and perceptions that are firmly entrenched in the public psyche.

Disclaimer

The opinions, findings, conclusions, and recommendations expressed in this paper represent the personal views of Dr. Girasek. They do not represent the views of any Federal agency.

References

Baker, S. P. 2000. Where have we been and where are we going with injury control? In D. Mohan, and G. Tiwari eds. *Injury prevention and control*. New York, NY: Taylor & Francis.

Beggs, S. D. 1984. *Diverse risks and relative worth of government safety programs: An experimental survey.* Report No. 700. Washington, DC: United States Environmental Protection Agency's Econonomic Analysis Division, 23 June 1984.

Bulger, E. M., A. B. Nathans, F. P. Rivara, M. Moore, E. J. MacKenzie, and G. J. Jurkovich. 2002. Management of severe head injury: institutional variations in care and effect on outcome. *Critical Care Medicine* 30 (8): 1870–6.

Carey, V., S. Chapman, and D. Gaffney. 1994. Children's lives or garden aesthetics? A case study in public health advocacy. *Australian Journal of Public Health* 18 (1): 25–32.

Centers for Disease Control and Prevention.2006. QuickStats: Percentage change in death rates for the leading causes of unintentional injury, by mechanism of injury—United States, 1999–2003. *MMWR* 55 (25): 706. June 30, 2006.

Chandler, C. C, L. Greening, L. J. Robison, and L. Stoppelbein. 1999. It can't happen to me…or can it? Conditional base rates affect subjective probability judgments. *Journal of Experimental Psychology:* Applied 5 (4): 361–378.

Chapple, A., S. Ziebland, and A. McPherson. 2004. Stigma, shame, and blame experienced by patients with lung cancer: Qualitative study. *British Medical Journal*, doi:10.1136/bmj.38111.639734.7C (published 11 June 2004).

Cleary, P. D. 1987. Why people take precautions against health risks. In N. D. Weinstein, ed. *Taking care: Understanding and encouraging self-protective behavior.* New York, NY: Cambridge University Press.

Corso, P., E. Finkelstein, T. Miller, I. Fiebelkorn, and E. Zaloshnja. 2006. *Incidence and lifetime costs of injuries in the United States* 12:212–8.

DeJoy, D. M. 1989. The optimism bias and traffic safety risk perceptions. *Accident Analysis & Prevention* 21 (4): 333–40.

———. 1992. An examination of gender differences in traffic accident risk perception. *Accident Analysis & Prevention* 24:237–46.

———. 1999a. Attitudes and beliefs. In *Warnings and risk communication* by M. S. Wogalter, D. M. DeJoy and K. R. Laughery, eds. Taylor & Francis: Philadelphia, PA.

———. 1999b. Motivation. In *Warnings and risk communication* by M. S. Wogalter, D. M. DeJoy, and K. R. Laughery, eds. Taylor & Francis: Philadelphia, PA.

Delaney, A., H. Ward, M. Cameron, and A. Williams. 2005. *Journal of Public Health Policy* 26 (4): 404–15.

Duan, L. 2004. A survey of unintentional childhood injury pattern and awareness in three cities in China. Presented to the *7th World Conference on Injury Prevention and Safety Promotion* in Vienna, Austria on June 8, 2004.

Eichelberger, M. R., C. S. Gotschall, H. B. Feely, et al. 1990. Parental attitudes and knowledge of child safety. *AJDC* 144:714–20.

Girasek, D. C. 1999. How members of the public interpret the word accident. *Injury Prevention* 5:19–25, 1999.

———. 2000. Injury's perceived association with stupidity. Presented at the *5th World Conference on Injury Prevention and Control* in New Delhi, India.

———. 2001. Public beliefs about the preventability of unintentional injury deaths. *Accident Analysis & Prevention* 33:455–65.

———. 2005. Advice from bereaved parents: On forming partnerships for injury prevention. *Health Promotion Practice* 6 (2): 207–13.

———. 2006. Would society pay more attention to injuries if the injury control community paid more attention to risk communication science? *Injury Prevention* 12:71–73.

Girasek, D. C., and A. C. Gielen. 2003. The effectiveness of injury prevention strategies: What does the public believe? *Health Education and Behavior* 30 (3): 287–304.

Girasek, D. C., A. C. Gielen, and G. S. Smith. 2002. Alcohol's contribution to fatal injuries: A report on public perceptions. *Annals of Emergency Medicine* 39:622–30.

Glik, D. C., J. J. Kronnenfeld, K. Jackson, and W. Zhang. 1999. Comparison of traffic accident and chronic disease risk perceptions. *American Journal of Health Behavior* 23 (3): 198–209.

Global Lung Cancer Coalition. 2003. No one in the world deserves lung cancer. Call to action to lessen the stigma of the disease and pressure governments to increase funding. News Release October 30, 2003. Available online at http://www.prnewswire.co.uk/cgi/news/release?id=110904

Greening, L., and C. C. Chandler. 1997. Why it can't happen to me: The base rate matters, but overestimating skill leads to underestimating risk. *Journal of Applied Social Psychology* 27:760–80.

Harré, N., S. Foster, and M. O'Neill. 2005. Self-enhancement, crash-risk optimism and the impact of safety advertisements on young drivers. *British Journal of Psychology* 96:215–30.

Harris, P. 1996. Sufficient ground for optimism? The relationship between perceived controllability and optimistic bias. *Journal of Social and Clinical Psychology* 15:9–52.

Hayakaw, H., P. S. Fischbeck, and B. Fischhoff. 2000. Traffic accident statistics and risk perceptions in Japan and the United States. *Accident Analysis and Prevention* 32:827–35.

Hewstone, M. 1996. Bias. In A. S. R. Manstead and M. Hewstone, eds. *The Blackwell Encyclopedia of Social Psychology* Oxford, UK: Blackwell Publishing, p. 89.

Hooper, R., C. A. Coggan, and B. Adams. 2003. Injury prevention attitudes and awareness in New Zealand. *Injury Prevention* 9:42–47.

Hu, X., D. Wesson, P. Parkin, et al. 1996. Pediatric injuries: Parental knowledge, attitudes and needs. *Canadian Journal of Public Health* 87:101–5.

Insurance Institute of Highway Safety. 2006. *Q & A: Motorcycle helmet use laws*. Available online: http://www.iihs.org/research/qanda/helmet_use.html. Accessed January 10, 2006.

Jones-Lee, M. W., M. Hammerton, and P. R. Philips. 1985. The value of safety: Results of a national sample survey. *The Economic Journal* 95:49–72.

Lonero, L. P., K. M. Clinton, and D. A. Sleet. 2006. Behavior change interventions in road safety. In Gielen, A. C., D. A. Sleet, and R. J. DiClemente eds. *Injury and Violence Prevention: Behavioral Science Theories, Methods and Applications*. San Francisco, CA: Jossey Bass.

McCarthy, M. 1996. Controversy children and cycle helmets—the case against. *Child Care Health Development* 22 (2): 105–11.

McEvoy, S. P., M. R. Stevenson, and M. Woodward. 2006. The impact of driver distraction on road safety: Results from a representative survey in two Australian states. *Injury Prevention* 12:242–7.

McKenna, F. P. 1993. It won't happen to me: Unrealistic optimism or illusion of control? *British Journal of Psychology* 84:39–40.

McKenna, F. P., and I. P. Albery. 2001. Does unrealistic optimism change following a negative experience? *Journal of Applied Social Psychology* 31 (6): 1146–57.

McKenna, F. P., and M. S. Horswill. 2006. Risk taking from the participant's perspective: The case of driving and accident risk. *Health Psychology* 25 (2): 163–70.

McKenna, F. P., and L. B. Myers. 1997. Illusory self-assessments—can they be reduced? *British Journal of Psychology* 88:39–51.

Mendeloff, J. M., and R. M. Kaplan. 1989. Are large differences in "life-saving" costs justified? A psychometric study of the relative value placed in preventing deaths. *Risk Analysis* 9:349–63.

Mohan, D. 2000. Injury control and safety promotion: Ethics, science, and practice. In D. Mohan and G. Tiwari, eds. *Injury Prevention & Control*. New York, NY: Taylor & Francis.

Morrongiello, B. A., and H. Rennie. 1998. Why do boys engage in more risk taking than girls? The role of attributions, beliefs, and risk appraisals. *Journal of Pediatric Psychology* 23 (1): 33–43.

Naisbett, H. J. 1961. The great holiday massacre. *Traffic Safety* 58:12–15, 36, 48–49.

National Center for Injury Prevention and Control. 2006. *10 Leading Causes of Death, United States, 2003*. Office of Statistics and Programming, Centers for Disease Control and Prevention. Accessed July 19, 2006.

National Highway Traffic Safety Administration. 1997. Crashes aren't "accidents" campaign. *NHTSA Now!* 3 (11): 1–2.

———. 1999a. Speeding and aggressive driving documented in a national telephone survey. *Traffic Tech* No 186. Washington, DC: US Department of Transportation, January 1999.

———. 1999b. National survey finds most people want more enforcement of unsafe driving. *Traffic Tech* No 187. Washington, DC: US Department of Transportation, January 1999.

———. 2000. *Traffic Safety Facts 2000: Alcohol*. Accessed July 11, 2006. Available at: http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/ncsa/tsf2000/2000alcfacts.pdf.

Northcutt, W. 2000. *The Darwin Awards: Evoluation in action*. New York, NY: The Penguin Group.

Ollendick, T. H., N. J. King, and R. B. Frary. 1989. Fears in children and adolescents: Reliabililty and generalizablity across gender, age, and nationality. *Behav. Res. Ther* 27 (1): 19–26.

Perloff, R. M. 1993. *The dynamics of persuasion*. Lawrence Erlbaum Associates: Hillsdales, New Jersey.

Petridou, E., X. Zavitsanos, N. Dessypris, C. Frangakis, M. Mandyla, S. Doxiadis, and D. Trichopoulos. 1997. Adolescents in high risk trajectory: Clustering of risky behavior and the origins of socioeconomic health differentials. *Preventive Medicine* 26:215–9.

Research!America. 2005. *Americans aware that injury is the leading killer of young people*. A public opinion survey for Research!America. Alexandria, VA, Spring 2005.

Roberts, I., and C. Coggan. 1994. Blaming children for child pedestrian injuries. *Social Science and Medicine* 38 (5): 749–53.

Sandman, P. M. 1987. Hazard versus outrage in the public perception of risk. In Covello, V. T., D. B. McCallum, and M. T. Pavlova. *Effective risk communication: The role and responsibility of government and nongovernmental organizations*. New York, NY: Plenum Publishing Group.

Schopper, D., C. Ammon, A. Ronchi, and A. Rougemont. 2000. When providers and community leaders define health priorities: The results of a Delphi Survey in the Canton of Geneva. *Social Science and Medicine* 51:335–42.

Shaw, F. E., and C. P. Ogollo. 2006. Law, behavior and injury prevention. In A. C. Gielen, D. A. Sleet, and R. J. DiClemente, eds. *Injury and violence prevention: Behavioral science theories, methods, and applications*. San Francisco, CA: Jossey Bass.

Sjöberg, L., M. Peterson, J. Fromm, A. Boholm, and S. Hanson. 2005. Neglected and overemphasized risks: The opinions of risk professionals. *Journal of Risk Research* 8:599–616.

Skitka, L. J., and P. E. Tetlock. 1993. Providing public assistance: Cognitive and motivational processes underlying liberal and conservative policy preferences. *Journal of Personality and Social Psychology* 65 (6): 1205–23.

Sloan, R. P., and J. C. Gruman. 1983. Beliefs about cancer, heart disease, and their victims. *Psychological Reports* 52:415–24.

Slovic, P., B. Fischoff, and S. Lichtenstein. 2001a. Accident probabilities and seat belt usage: A psychological perspective. In P. Slovic, ed. *The perception of risk*. Sterling, VA: Earthscan Publications.

———. 2001b. Facts and fears: Understanding perceived risks. In P. Slovic, ed. *The perception of risk*. Sterling, VA: Earthscan Publications.

Stone, D. 1989. Upside down prevention. *Health Services Journal* 99:890–1.

Taylor, S. E., and J. D. Brown. 1994. Positive illusions and well-being revisited: Separating fact from fiction. *Psychological Bulletin* 116 (1): 21–27.

Tesh, S. N. 1988. *Hidden arguments: Political ideology and disease prevention policy*. New Brunswick, NJ: Rutgers University Press.

Torrell, U., and S. Bremberg. 1995. Unintentional injuries: Attribution, perceived preventability, and social norms. *Journal of Safety Research* 26 (2): 63–73.

US General Accounting Office. 1987. *Drinking age laws: An evaluation synthesis of their impact on highway safety.* Washington, DC: US General Accounting Office.

Vicenten, J. A., M. J. Sector, W. Rogmans, et al. 2005. Parents' perceptions, attitudes and behaviours towards child safety: A study in 14 European countries. *International Journal of Injury Control and Safety Promotion* 12:183–9.

Vogel, D. 1991. When consumers oppose consumer protection: The politics of regulatory backlash. *Journal of Public Policy* 10:449–70.

Wagenaar, A. C., and S. Farrell. 1988. Alcohol-control policies: Their role in preventing alcohol-impaired driving. In: *Surgeon General's workshop on drunk driving: Background papers*. Washington, DC: Office of the Surgeon General.

Wallack, L. 1997. *Presentation to the Johns Hopkins Summer Institute: Principles and practices of injury prevention*.

Walton, D., and P. C. McKeown. 2001. Drivers' biased perceptions of speed and safety campaign messages. *Accident Analysis and Prevention* 33:629–40.

Weiner, B., R. P. Perry, and J. Magnusson. 1988. An attributional analysis of reactions to stigmas. *Journal of Personality and Social Psychology* 55 (5): 738–48.

Weinstein, N. D. 1980. Unrealistic optimism about future life events. *Journal of Personality and Social Psychology* 39 (5): 806–20.

———. 1982. Unrealistic optimism about susceptibility to health problems. *Journal of Behavioral Medicine* 5:441–60.

———. 1987. Introduction: Studying self-protective behavior. In N. D. Weinstein, ed. *Taking Care: Understanding and Encouraging Self-protective Behavior.* New York, NY: Cambridge University Press.

Wikipedia. 2006. *Fundamental attribution error.* Online at: (Accessed June 23, 2006.) http://en.wikipedia.org/wiki/Fundamental_Attribution_Error.

Biographical statement

Deborah C. Girasek, Ph.D., MPH, is the Director of Social and Behavioral Sciences in the Department of Preventive Medicine at the Uniformed Services University of the Health Sciences (USUHS). USUHS is a Federal medical school located in Bethesda, Maryland.

Earlier in her career Dr. Girasek served as a Senior Advisor to the Deputy Assistant Secretary of Health for Disease Prevention and Health Promotion in Washington, DC, and as the Director of Health Communications at Memorial Sloan-Kettering Cancer Center in New York.

She received her Masters in Public Health from the University of Michigan and a Ph.D. in the Social and Behavioral Sciences from the Johns Hopkins School of Public Health. Dr. Girasek's research focuses on social and behavioral factors that influence unintentional injury prevention. Her methodologic specialties include needs assessment and survey research.

Addressing behavioral elements in traffic safety:
A recommended approach

Robert Foss

University of North Carolina at Chapel Hill

Overview

The purpose of this paper is to describe a better way to go about the enterprise of altering the behavior of drivers, where far less progress has been made than in the engineering of safer roads and vehicles. In thinking about doing so, the concept “traffic-safety culture” is quite appropriate. In a sense, this paper presents the argument that a traffic-safety culture should involve a reordered set of values, different beliefs from those that are now common, and, as a consequence, altered norms for appropriate behavior of its members. This applies whether the notion of a traffic-safety culture is narrowly constrained to professionals working in the traffic-safety domain or is more broadly defined to incorporate much of the population of a nation.

The fundamental point presented here is that to reduce traffic-related deaths and injuries, we must take a far more enlightened approach to developing and implementing programs and policies than is presently the case. To achieve meaningful declines will require taking advantage of the vast stores of scientific understanding that are currently overlooked. The following paper includes a brief description of how we presently operate, why the current approach works poorly, why it occasionally succeeds, a listing of several pertinent well-established fundamental principles of human behavior, and a suggestion for how we can do better in the future.

Common sense nonsense

In principle, there are only two ways in which a program can fail to achieve its goal. Either it is based on an incorrect understanding of the phenomenon that it seeks to address, or the fundamental principles of a conceptually sound program are not effectively put in place. In traffic safety, we often come up short on both counts.

As an applied social psychologist, I am concerned by the degree to which—as a profession—the field of traffic safety seems to function almost exclusively on the basis of common sense notions about the nature and functioning of individuals, groups, and organizations. A large proportion of programs that are intended to alter human behaviors in ways that should result in safer travel—from consistently wearing a seat belt, to driving at safe speed, to avoiding various driving distractions, to not driving while impaired by any of several substances or conditions, to training new drivers—are based on overly simplistic notions of the determinants of human behavior. As a result, these efforts all too often fail. Sometimes the conceptual design of programs is predicated on incorrect or inadequate understanding of human behavior. In other cases, conceptually sound programs or policies are poorly implemented because the designer or practitioners fail to understand fundamental principles of the functioning of human organizations, institutions, and social

systems. In those cases where programs do succeed, it is often by luck more than through development and use of a sound conceptual underpinning. Important fundamental principles can be tapped inadvertently and sometimes they are, but hoping for good luck is not a particularly efficient approach.

Despite the availability of decades of research findings in the various social and behavioral sciences, which hold valuable insights that are applicable to our goal of modifying safety-related behaviors, we tend to turn inexorably and repeatedly to programs, policies, and laws that reflect a substantial failure to understand, and address, the tremendous complexity of human behavior. Instead of tapping what is known about human functioning, we routinely develop and implement approaches based on a few overly simplistic notions about human behavior. In particular, we assume (with unjustified confidence) that threatening punishment and providing factual information are effective ways to alter human behavior. "Raising awareness," dispensing traffic citations, and increasing prescribed penalties for infractions account for the majority of the efforts undertaken to influence human behavior in pursuit of traffic safety.

Clearly, knowledge plays some role in many human actions, but the notion that simply providing information will translate directly into changes in behavior is demonstrably wrong in most cases. It overlooks the large number of other determinants of behavior, presuming that wise behavior results directly from the possession of factual knowledge. It also presumes, incorrectly, that distributing facts or admonitions equates to the receipt, understanding, memory, motivation to comply with, and timely use of the intent of a message by the entire driving population. Every step in that process is fraught with complexities that degrade the ultimate effect of any message (National Committee for Injury Prevention and Control 1989).

Most programs that are designed to provide information or "raise awareness" are never evaluated. Those that are evaluated routinely illustrate the difficulty of changing safety-related behaviors. A recent example of efforts to alter behavior by providing information involves the hundreds of different books, brochures, pamphlets, and web sites intended to "educate" parents of teen drivers, with the intent of increasing the teens' safety. One unusually high-quality example of this approach was recently evaluated in two separate studies. Both found that distribution of this well-designed, practical, easily used guide had no effect on parental behaviors regarding their teens' driving (Goodwin et al. 2006; Chaudhary, Ferguson, and Herbel 2004). Educational programs to increase child safety seat use do no better (Zaza et al. 2001).

Despite readily available evidence in our everyday dealings with friends, family, and coworkers, humans cling tenaciously to the belief that individuals can be persuaded to engage in any behavior simply by being told that they should do so. Scientific evidence also abounds to indicate that human beings are not very easy to change. More than a third of a century ago, a prominent social scientist cited numerous instances of programmatic efforts to alter human behaviors that had failed to produce the behavior changes they sought (Etzioni 1972). He also cited evidence that adopting a more informed approach can produce changes in behavior.

Similarly, the belief that threatening punishment, or increasing the severity of threatened punishment, is an effective means to alter human behavior flies in the face of decades of research and numerous well-supported conceptualizations of human behavior. As with the misplaced faith in messages, beliefs about the effect of punishment also overlook the complexities of the human world that often render punishment-based programs substantially inoperative. As every child learns at an early age, the severity of threatened punishment is irrelevant if one can avoid being detected. They also learn that, if caught, it is usually possible to negotiate a far less serious end

result, rendering the threat always less than it appears on the surface. Those critical principles are routinely ignored by programs that focus on issuing citations or making arrests and by policies that focus on increasing prescribed penalties. Although individuals involved in traffic law enforcement recognize and lament the leaks in the system, those who create the system tend to focus, in a largely futile effort, on plugging holes rather than on designing a well-integrated system, predicated on an understanding of individual human behavior as well as the functioning of human groups, organizations, and cultures.

Operating on the basis of implicit, rarely questioned beliefs and numerous corollary notions, about how to affect individual actions has resulted in a failure to achieve progress that is possible. Failing to appreciate that human behavior is at least as complex as physical and biological systems, we rarely take advantage of the fundamental theoretical principles of human functioning that are well known to psychologists, sociologists, political scientists, anthropologists, biologists, economists, human communication experts, and others whose life work is dedicated to understanding the many, complexly interrelated principles of human behavior. This limited vision of human behavior characterizes many fields, not simply traffic safety. Though this is not uniquely our problem, it is one that we need to correct. Using the vast stores of existing knowledge about human functioning to craft traffic-safety programs and policies will result in efforts that truly have the potential to achieve substantial reductions in deaths and injuries resulting from motor vehicle crashes. Although we can point to successes, they are much too rare, and we can do better.

Implementing poorly reasoned programs is immensely costly. Not only do such programs have little chance of working, they are doubly costly in that they consume limited resources (money, time, political capital) that might otherwise have been devoted to other, more productive undertakings. This is an important central concept in economics, known as the "opportunity cost" of an action, that seems rarely to be considered in traffic safety. When working with traffic-safety practitioners and advocates, one often hears some version of the statement: "If this saves just one life, it will be worth it." Although the sentiment expressed is understandable, the belief reflects an unacceptably naïve perspective. Absent unlimited resources, we really should devote what we have available to those programs and policies that are most likely to bring about change in the most prevalent problem behaviors. Saving one life by using funds, or other resources, that might have saved a hundred if applied differently is irresponsible, not noble.

The general point that science, rather than common sense, must guide our efforts if we hope to do better is hardly novel (Sivak 2002; Williams 2004), but in traffic safety as well as some other applied fields, the principle is followed poorly at best. Interestingly, medicine is the one other field where a poor application of existing scientific knowledge may fail to preserve lives that need not be lost. Despite that similarity to our field, there is far less tolerance for the application of "hunch-based" remedies in medicine than is the case in traffic safety.

The unfortunate truth is that most activities undertaken to improve traffic safety by altering driver/operator/passenger behavior have failed to achieve their goal to any meaningful degree. This assertion may come as a surprise to those outside the field and, perhaps, to many of those dedicated individuals whose lives are immersed in frontline efforts to reduce travel-related injuries and fatalities. It will surprise few researchers, however. A recently released report on national progress in improving traffic safety during the past decade (Farmer and Lund 2006) makes this point as well—identifying progress from vehicle engineering improvements—but finding little benefit resulting of our multimillion dollar efforts to address behavioral aspects of

traffic safety. Further, more detailed, documentation of the few successes and many failures is included in the recent report "Countermeasures that work" (Hedlund 2006).

It is something of a puzzle that the failure to follow the existing literature on well-established principles mainly characterizes only the human side of traffic safety. The physical infrastructure, including both the roadway system and the vehicles we use, is designed with extreme care and detailed attention to relevant fundamental principles derived from scientific research. Human-oriented programs, on the other hand, tend to be designed—though perhaps concocted is a more appropriately descriptive term—with little or no attention to the literature on the functioning of humans and human systems (organizations, cultures, institutions). Although engineering efforts have generally been well grounded in the physical sciences, there are many instances wherein engineering interventions that are designed to address human behavior fail because they don't follow principles of human behavior as well as they follow principles of physics. It appears that the problem resides more in the domain of operation (physical vs. human phenomena) than in the disciplinary background or training of those who design the programs (engineers vs. others).

Successful programs in traffic safety

There have been some particularly noteworthy successes in efforts to alter drivers' behavior. There is a valuable lesson in the successes. Rather than being programs, or laws, these involved a combination of both, in recognition of the complexly determined nature of human behavior. It turns out that the clear successes we achieve tend to occur when scientifically sound concepts have been implemented, whether by design or through good fortune.

Promoting seat belt use, deterring drinking drivers

Perhaps the most widely acclaimed and broadly adopted strategy to alter driver behaviors in the past two decades has been the *high visibility enforcement* approach embodied in *Click-it-or-Ticket* programs to promote seat belt use and the deployment of well-publicized DWI check-points throughout a jurisdiction to deter alcohol-impaired driving. There is ample research evidence to indicate that, when properly employed (i.e., when the important underlying processes are engaged through careful program implementation), this approach produces increased belt use and decreased driving after drinking. It is significant that this approach derives directly from one of the standard theories in the sociology of deviance, *General Deterrence Theory.* This idea was brought most forcefully and clearly to the traffic-safety field—to inform DWI countermeasure efforts—by H. L. Ross (1982), a lawyer and academic sociologist.

Many who strongly embrace the principle that punishment must be swift, certain, and severe, probably have no idea that it originated with a sociologist and was supported by hundreds of studies of all manner of behaviors having nothing to do with impaired driving or seat belt use. Although it is not necessary to know the history of a conceptually valuable approach, it is important to understand the essential principles by which it operates. Simply invoking the general idea, knowing the name but not the substance, is insufficient. That lack of substantive understanding

can easily lead to the deployment of programs or enactment of policies or laws that fail to set important processes in motion.

Implementation fidelity

Substantially less progress has been made in deterring drinking drivers than in encouraging seat belt use. These are clearly different phenomena so that is not surprising. However, there has also been a difference in our approach to these behaviors. The value of a sound program can be lost if the underlying principles upon which it operates are not tapped by a specific implementation. That has occurred often in efforts to reduce impaired driving. This procedural error can be clearly seen where high-visibility enforcement programs often turn into mostly just enforcement, with insufficient attention given to ensuring widespread publicity. There are many reasons that this happens, but regardless of the reason, doing enforcement alone fails to invoke the underlying mechanism by which enforcement works most effectively—persuading large numbers of drivers that detection and punishment are (more) likely—with the result that program benefits are far less than they might be.

Another way in which the benefits of the general deterrence model are easily lost can be seen in the recent effort of the National Highway Transportation Administration to reenergize activities to reduce alcohol-impaired driving. The program was reported in the Aug 16, 2006 edition of the *New York Times* as follows:

> *"The National Highway Traffic Safety Administration announced Wednesday that it had signed up thousands of law enforcement agencies across the country to begin a campaign to crack down on drunken drivers through Labor Day."* [emphasis added]

The all important publicity about the program inadvertently informed drivers that this effort was apparently to last only for a few weeks, thereby undercutting the potential long-term effect that would otherwise be expected. Delimiting the time period such a program covers is comparable to publicizing that a DWI checkpoint will be implemented at a particular location, on a particular night, thereby providing the target population with the information needed to avoid program activity. The $11 million dollars spent on publicity for this program seem like a lot to invest for a two-week effect, or even a two-month effect, assuming there may have been some carryover benefit.

To effectively invoke the underlying principle of high-visibility enforcement programs requires that enforcement activities be publicized in such a way that potential drinking drivers believe that enforcement is being increased and are left with no idea where, how, or for how long the additional enforcement activity will occur. There needs to be a sufficient amount of visible enforcement activity—DWI or seat belt checkpoints—to sustain the credibility of the publicity but, because the chances of any individual driver actually seeing a checkpoint are small, high-profile media reminders are essential (Reinfurt 2004).

A program in Tennessee implemented a high-visibility enforcement program, deploying DWI checkpoints throughout the state for a year. The activity was widely publicized and involved

several checkpoints every weekend in varying locations, adhering closely to the basic principle. The result was a substantial reduction (20%) in fatal crashes involving a driver with an alcohol concentration of 0.10% or higher (Lacey, Jones, and Fell 1996). A more or less contemporaneous, but longer-lasting, program in North Carolina evolved into a "blitz" approach after the first several months, concentrating enforcement activity and publicity within a few 2-week to 3-week periods each year. Much like the recent national effort, the publicity in North Carolina also tended to explicitly identify the time periods that would be covered by the program. Despite deploying thousands more checkpoints each year than the Tennessee program, the North Carolina effort resulted only in a small, short-term decline in alcohol-related crashes. The effect lasted only through the initial program period, when publicized enforcement was both widespread and more or less continual. The Tennessee program, in contrast, appears to have produced a substantially greater and more enduring benefit, with less effort and at substantially lower cost. Following underlying principles, not simply general ideas, is critical.

In reality, neither programs nor policies or laws do anything to affect behavior. They are simply tools by which important principles can be invoked. If the principles are sound ones and are effectively put in place by a program or policy, the targeted behaviors are then quite likely to change. We would do well to think about trying to invoke principles, rather simply about passing laws or implementing programs. Although passing recommended laws or implementing evidence-based programs would seem to be the best we can do, it is not. Any strategy that, for whatever reason, does not successfully put in place the important principles it is intended to has little hope of achieving its goal. Thus, it is important to do more than simply go through the motions of enacting recommended approaches. Fidelity of implementation is critical.

The nature of human behavior

There is clearly insufficient space here to explain all that is known about human behavior by, literally, the hundreds of thousands of highly trained individuals whose lives are spent studying this extremely complex phenomenon. I do, however, want to offer just a few observations based on what I take from reading the literature of a number of disciplines for the past several decades. Although much remains a mystery about human behavior, just as is the case with the physical world, there is a good deal of understanding that currently goes unused as we try to develop programs to increase transportation safety.

Some fundamental principles of human behavior

Below are a few very broad, general principles that, it seems to me, are highly relevant to our efforts to improve traffic safety, but which have not often been actively used to guide program/policy development. Many of these have been the focus of a great deal of theoretical work. As we get down to details of putting programs in place, all too often the implications of these fundamental aspects of human behavior are lost.

The result is goals are not met, injuries not prevented, and lives not saved.

- Humans understand, retain, and use only a small fraction of the "objective" information they hear or read. They generally use only the "gist," not the details, even of highly relevant factual information provided to them (Reyna 2004).
- Humans are not passive, information-receiving entities. Rather they are active, meaning-seeking, information-processing, impression-forming, emotionally driven beings (Bandura 1986; Jones et al. 1972; Shibutani 1966).
- Much behavior occurs in response to the immediate environment (both physical and social) in which individuals find themselves at any given time (Ajzen and Fishbein 1980; Etzioni 1972; Stokols and Altman 1987).
- Most individuals are strongly influenced by the behavior of others in nearly all things, though not so mechanically that they simply do what others ask or tell them to do. Social influence processes are far more complex than to fit such a deterministic notion (Bandura 1986, 1989).
- A substantial proportion of human action is habitual, rather than based on conscious decisions each time behaviors are performed (Ajzen 1991).
- All humans live in groups, both large and small, whose values and informal, unwritten rules influence their members' thoughts and behaviors (Norenzayan and Nisbett 2000; Triandis 1994).
- Humans are biological beings, many of whose behaviors are influenced to some degree by biological factors (e.g., sex and age-related conditions). For the most part, these biological factors cannot be altered—they can, however, be recognized and, in at least some instances, accommodated (Pinel 2007).
- Human organizations and institutions, not individuals, are the mechanisms by which most programs and policies are implemented. Understanding their functioning is critical to the effective implementation of those programs and policies (Kreitner and Kinicki 2004).

Knowledge into action

Shifting program and policy development away from a "shoot from the hip" commonsense based orientation to a theoretically grounded approach is not an easy assignment. Scholars and researchers in the social and behavioral science fields have not done a good job of translating their fundamental understanding—which, though less than perfect, is substantial—into usable guidelines for practitioners. Part of the reason for this is that many social/behavioral researchers do not see their efforts as directed toward specific applied questions (like how to reduce risky driving behaviors) so much as toward simply furthering our general understanding of the human condition. As a result, valuable insights and findings, with clear potential applicability in many domains, are left for others to translate into applications. The unfortunate, but not surprising, result is that those who develop programs, policies, and laws rarely know there is a substantial knowledge base upon which they might draw. Moreover, the existing knowledge is rarely available in a form that can easily be used by persons not familiar with the field from which it derives, be that psychology, sociology, economics, biology, mass communication, political science, or any of a number of other pertinent disciplines. Nonetheless, if we hope to alter human driving

behavior in ways that increase safety, our best hope is to understand the multiplicity of factors that are at play in human functioning.

Theory is invaluable

One of the more strongly endorsed fundamental principles of science, and one of the least understood by nonscientists, is the value of theory. In brief, a theory is nothing more than an attempt to use abstract concepts to capture and summarize as much existing factual knowledge as possible in a sufficiently concise form that it can easily be used. Theory can be thought of as analogous to a road map. Although it is an attempt to provide an understandable representation (conceptual model) of some reality, it doesn't need to perfectly reflect every detail of the terrain it describes in order to be useful. It doesn't have to be complete nor does it need to be completely correct. To be useful, a theory simply needs to be good enough to give the users some helpful guidance in reaching their goals or destinations. Without a map, a person can simply wonder around and may eventually reach an intended destination. A crude map can be very helpful, a more refined one even better, but a perfect representation of every feature of the landscape is not really needed. Kurt Lewin, widely considered to be the father of social psychology, was theoretically oriented but was also intensely interested in using scientific understanding to better the human condition. Probably his best known quote attests to the value of theory in guiding practical work, "There is nothing so practical as a good theory." (Marrow 1969).

When a theory has proved to be reasonably adequate in providing a concise, abstract description of a multitude of empirical facts about a particular phenomenon (e.g., a behavior or class of behaviors)—by generating accurate predictions—it can then be used as a tool to guide the development of programs to influence the behavior described. There are many such theories in the social and behavioral sciences that have been developed through the life work of thousands of individuals. These spell out general principles that can help guide programs and policies to alter driving-related behaviors. They point to the sorts of things that are necessary to success and also help to identify the kinds of approaches that, in view of how humans actually function, are simply hopeless and which we would do well to avoid.

As the fundamental principle of a traffic-safety culture, every program, policy, and law whose goal is to reduce motor vehicle-related injuries and deaths should be derived from, or be demonstrably consistent with, well-documented fundamental principles of human behavior. To implement this principle, we should consciously and conscientiously use existing, well-supported theories in several of the social/behavioral sciences as guides in developing program and policy ideas. In cases where a strategy has been developed in the absence of theoretical guidance, it should be carefully vetted against sound theory before being implemented. If there is no theoretical support, the plan should either be revised before implementation or scrapped. Allowing for the fact that much remains to be understood about human behavior, if there is no apparent theoretical support, but also no clear contraindication for a proposed program—something that would be rare—then it might be reasonable to proceed on a small-scale, trial basis, with a careful evaluation plan in place. This might seem to resemble present recommended practice—implement then evaluate—but it is different. Although evaluation is routinely suggested, or required, evaluation cannot salvage a fundamentally flawed approach. It can merely document its failure.

Consideration of demonstrably effective programs can be a source of inspiration for how to tackle a different issue. This is one way in which a promising idea might arise from a nontheoretical base. However, trying to adapt a program to address a different driving behavior risks losing the fundamental principles by which the original program works. A careful conceptual analysis of an effective approach, to determine whether the principles by which it succeeds are appropriate to the new domain and can be similarly tapped with the same program structure, is important. If similar fundamental principles apply to the newly targeted behavior and can be implemented by a similar program, comparable success may be expected.

Some useful theoretical tools

To point to some valuable intellectual resources that have remained largely untapped by traffic-safety practitioners, advocates and researchers, I offer brief descriptions of three particular theories that have stood the test of time and scientific scrutiny. They have been developed through the efforts of dozens of researchers following the scientific process of conceptualization, prediction, assessment, revision, and refinement, over the past several decades. With each description, I offer what I believe to be some of the implications of these theories for the field of traffic safety.

Theory of reasoned action

The *Theory of Reasoned Action* (TRA) originated in efforts during the 1970s to reconcile the fact that attitudes were repeatedly found to have little or no relationship to behavior (Ajzen and Fishbein 1980). In the process of trying to resolve that seeming contradiction, by more carefully specifying just what "attitude" means and a mechanism by which it should reasonably predict (and "cause") behavior, researchers ended up with a broad general model of human behavior. In brief, TRA suggests that the likelihood of an individual engaging in a particular action is approximated by people's behavioral intent, which in turn is a function of their attitudes toward that particular action as well as beliefs about whether important others would expect them to engage in the action. Unlike many behavioral theories, TRA has been described algebraically, which is

$$B \approx B_i = w_1 \sum_{i=1}^{n} B_i E_i + w_2 \sum_{j=1}^{m} NB_j MC_j$$

highly useful, allowing the concise presentation of several elements and their inter-relationships:

where:

B_i = beliefs about the possible consequences(i) of the behavior

E_i = evaluation of the possible consequences

NB_j = normative beliefs about behavior by person j

MC_j = motivation to comply with expectations of person j

w_1, w_2 = weighting factors to indicate relative contributions of beliefs about the act, and normative expectations for a particular behavior

TRA applies only to those behaviors a person is able to perform; that is, they are not controlled by factors beyond the individual's influence or capability. It also does not apply to behaviors that are essentially habitual. This conceptualization has been used widely, in numerous applied fields, to guide the development of interventions to alter individual behaviors. Interestingly, though TRA has rarely been at the root of efforts to improve traffic safety, some of the more successful approaches are highly consistent with the tenets of TRA and could have been derived from it. In particular, high-visibility enforcement programs to encourage seat belt use or discourage drinking driving explicitly seek to affect drivers' "attitude" toward those acts by increasing their belief that a particular negatively evaluated consequence—citation or arrest—will occur. Similarly, in the past several years, a number studies have shown that altering perceptions about what others are doing and, therefore what is considered to be normative, can decrease excessive drinking (Perkins 2003) and driving after drinking (Goodwin 2004) among college students. TRA can be particularly useful in traffic-safety program development by fostering clear, precise thinking about the many tactics that might be tried. This kind of guidance often leads to novel ideas that would otherwise come to mind.

Social cognitive theory (Social learning theory)

Originally developed as an explanation of social learning (how individuals learn about social behaviors, as opposed to factual knowledge or skills), its originator Albert Bandura (1986) has expanded and refined *Social Cognitive Theory* (SCT) over the years to the point that it can be considered a fairly broad theory of human social behavior. Along with many other theoretical perspectives, SCT emphasizes the central role of social norms in guiding human behavior. Social norms, simply put, are well-understood, informal expectations for how members of any social group—be it family, friendship group, work organization, or entire society—are expected to behave. They are learned, largely by observation. Although norms are usually enforced only informally, they have an extremely powerful effect on human social behavior. Norms are particularly relevant to traffic safety, in part because laws can be viewed as formal codification of certain norms that are considered to be particularly important in a society. It is always understood in all societies that one should not kill another human being, with rare exceptions. Nonetheless in all modern societies this expectation is considered so important that it is formally codified. This points to one of the central features of the way in which laws influence human behavior. Rather than simply forcing individuals to behave in a way that they don't necessarily want, laws serve an informational function, communicating to members of a society that a particular behavior is considered particularly important. This is, to a substantial degree, how and why most traffic-safety laws work (and why others don't). It is simply not possible, at least in a democratic society, to force a population to comply with laws that do not represent widely embraced norms. It is, however, feasible to stress the societal importance placed on a particular behavior. And it is possible to bring the law enforcement powers of the state to bear on the small number who may wish to disregard a widely accepted law. There are very clear implications here for what are and are not realistic expectations for the role of law in promoting traffic safety.

A significant addition to Bandura's original theory of social behavior is an identification of the crucial role of perceived self-efficacy. It is now well documented that a critical determinant in human behavior, which intervenes between motivation and action, is the sense that one can actually perform a behavior. Those with little confidence in their ability to do so will give up easily, whereas those who believe they can will be far more dedicated. The use of child safety seats provides a good example of where this is highly relevant. Even today, a quarter century

after initial state requirements for parents to buckle their children into safety seats, these devices are still tedious, difficult, and trying to use. They require determination, physical adeptness, and sometimes substantial problem-solving ability. They also sometimes require great skill in persuading a strong-willed infant or toddler to do something he or she may not be inclined to do. Parents with little confidence in their ability to handle this nontrivial physical and interpersonal task will simply give up. Although perhaps inadvertently, many programs designed to provide safety seats and help parents learn to use them have also addressed parents' sense of self-efficacy to buckle-up their children. Another area where this concept is critical is in the need for parents to more effectively manage their teen's driving behavior, encouraging or requiring adherence to restrictions on the time, location, or conditions of their teen's driving. Some parents are quite good at persuading or negotiating with their teens. Others are often defeated by the teen's persistence, energy, and determination. Efforts to improve parents' sense of self-efficacy, along with information about what they should be doing, would seem to be a valuable undertaking by the traffic-safety community, and Bandura's theoretical conceptualization can provide guidance on how to do so.

Fuzzy-trace theory

Emerging from early research on the development of memory, *Fuzzy-Trace Theory* (FTT) has grown into a more general theory of human information-processing (Reyna 2004). In brief, FTT describes and explains the fact that humans do not generally use much of the objective, detailed, factual information they receive. Instead, they tend to reason based on imprecise ("fuzzy") stored information (known as "gist," rather than verbatim, memory). This has clear implications for how we try to persuade individuals about driving risk. It suggests that the use of anecdotes may be a wiser way to do this than by presenting statistical facts. A particularly significant finding of research undertaken on this model is that, whereas people tend to overestimate the magnitude of small risks, they also ignore very small risks. Given that the actual risk of a serious motor vehicle injury on any trip or even within a full year of driving is extremely small, FTT may be particularly useful in helping us understand why the driving public does not seem to be as concerned about traffic safety as traffic-safety professionals are and for helping us to know how to proceed in view of that discomforting fact. FTT also suggests that imprecise, intuitive analyses are preeminent in humans' thinking about risk. This directly contradicts the implicit assumptions about human information-processing that underlie many traffic-safety interventions. In combination with the implications of research suggesting the greater value of providing normative information to individuals, rather than factual information about risks of a nonnormative behavior (Perkins 2003), FTT may prove highly valuable in guiding traffic-safety practitioners in the future.

Implications for traffic safety culture

A truly meaningful Traffic Safety Culture ultimately must embrace only the principal value of effectiveness, eschewing all other motivations (including retribution, self-satisfaction, image-polishing, and extraneous political motivations). It will doggedly pursue only measurable benefits of programs and policies. A first step in that direction, indeed the root of the solution, is to recognize that human behavior is far more complex than can be explained by common sense notions. In order to progress very far, it will be necessary for us, as a (traffic-safety) culture, to

discard common sense ideas and the belief that because we are all humans, we necessarily understand how humans function. The lessons of the social and behavioral sciences must be learned, then adopted. Otherwise, we will continue to build programs that don't work, draining large proportions of extremely limited resources away from other initiatives that could. Fortunately, this does not require developing a new knowledge base; it simply means making better use of the vast reserve of information currently in existence. Even better, much of the most valuable existing knowledge has already been organized for us, through the development and testing of theory. We merely need to become better acquainted with the best, well established of these, then make conscious use of them.

Summary and recommendations

When programs or policies to increase traffic safety, follow well-established principles of human behavior, even if inadvertently, they are often successful. Those that follow common sense notions, which are often wrong and are always overly simplistic, generally fail. Accordingly, it is important to foster a deep-rooted dedication to developing approaches that tap fundamental principles of human behavior as detailed in the accumulated literature of the behavioral and social sciences. This is most efficiently done by following well-documented theoretical models. To set such a new direction, which is radical in action, though not as an idea, will require building an infrastructure and altering current values and beliefs—first within the traffic safety profession, then more broadly. A fundamental understanding that human behaviors are complex and simply can't easily be changed needs to supplant prevailing notions to the contrary. Demonstrable effectiveness of efforts to reduce crashes, rather than simply an appearance of being a good idea, needs to be the dominant value in a traffic-safety culture. Neither of these will be easy to accomplish, even within the relatively small circle of traffic-safety professionals. Simply telling individuals they should accept these notions will be no more effective than simply telling teens they should wear seat belts. Papers like this one won't bring about the suggested change. Guides, manuals, requirements in funding applications are unlikely to do much better. They may help contribute to the discourse, but human beings aren't that easy to change!

A critical step in moving the field toward this different way of thinking will likely be to demonstrate its success. That can be done by developing a mechanism whereby an understanding of the behavioral and social science literatures is brought directly to bear on a small number of salient, behaviorally based traffic-safety problems. It is unrealistic to believe that we can acquaint the masses, or even a small number of individuals, with all the requisite knowledge of the social and behavioral sciences. There are, however, individuals who already possess a good understanding of these literatures. Currently, researchers seem not to be directly involved very often in the development of programs. The primary involvement of researchers with practitioners occurs most frequently only through fleeting contacts at conferences, symposia, and workshops. A compelling argument can be made that to effectively put social and behavioral science principles to work in the design of programs will require inserting persons well versed in theoretical principles into the mix directly, rather than by trying to provide guidance primarily via written materials. That approach has been tried and it hasn't produced very well.

This is an ambitious and fairly radical notion. Nonetheless, it seems a worth trying in a pilot program. A few well-trained social/behavioral scientists with an understanding of the practical issues in traffic safety, as well as a strong grounding in a variety of social/behavioral science theories, could be made available to consult with state-based traffic-safety program and policy advocates, practitioners, and administrators. Many such groups eagerly welcome assistance of this type. Unfortunately, what they often get is, at best, a two-hour seminar, a one-day workshop, or something equally limited wherein they are told far more than they can possibly digest and far less than they need to know. Instead of trying to educate many and doing it poorly, it is worth trying a different approach, wherein persons who are well versed in bringing theoretical principles to bear on practical issues are assigned to work with a state or other comparably influential group on an extended basis, to help with implementing more promising approaches. Resulting programs would then need to be carefully implemented and properly evaluated to assess the value of such an approach.

Should this approach prove to be useful, a permanent program could be developed that might roughly be modeled on the Epidemiologic Intelligence Service (EIS) that the U.S. Centers for Disease Control has operated for many years. Rather than focusing on a training experience for young epidemiologists as the EIS does, the focus would be more on providing seasoned experts to states, though they would undoubtedly also learn a great deal with every placement or assignment in addition to bringing expertise of their own to the state.

Regardless of the details of how such a program could, or should, be organized, we simply need to get beyond the notion that human behavior is somehow easily understood and that it can easily and inexpensively be changed. The kind of extensive abstract knowledge about human behavior required to do what I am suggesting cannot be disseminated through pamphlets, how-to guides, “Traffic Safety for Dummies” books, or any of the mechanisms we now use. Physicians are not trained that way, nor are traffic safety engineers. At least for the foreseeable future, the sort of knowledge needed to produce dramatic reductions in motor vehicle crashes will have to reside in individuals, not in documents. A well-trained, savvy individual can bring to bear general principles in a specific situation in a way that someone with the limited knowledge gleaned from reading simply cannot.

The analogy with medicine is illustrative, but limited. The public health system may be a better model. Once well-designed programs to implement principles are enacted, they do not require the knowledge of the originator to continue working. Community-based child passenger safety programs provide an example of this. Similarly, a well-conceived law will continue to work with no further effort needed from the originators. This is nicely illustrated by laws to implement comprehensive graduated driver-licensing systems. Consequently, it is not entirely unrealistic to think that a relatively small number of carefully selected and deployed individuals might reasonably have a dramatic effect on the quality of efforts to reduce traffic crashes for decades to come.

References

Ajzen, I., and M. Fishbein. 1980. *Understanding attitudes and predicting social behavior.* Englewood Cliffs NJ: Prentice-Hall.

Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50:179–211.

Bandura, A. 1986. *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs NJ: Prentice-Hall.

———. 1989. Human agency in social cognitive theory. *American Psychologist 44:*1175–84.

Chaudhary, N.,. S. Ferguson, and S. Herbel. 2004. Tennessee's novice driver safety project: A program to increase parental involvement. *Traffic Injury Prevention* 5:356–61.

Etizioni, A. 1972. "Human beings are not very easy to change after all," Saturday Review (June 3, 1972), pp. 45–47. Reprinted in the Congressional Record (June 27, 1972), pp. S10274–S10275. (http://www.amitaietzioni.org/documents/B067.pdf).

Farmer, C. M., and A. K. Lund. 2006. Trends over time in the risk of driver death: What if vehicle designs had not improved? *Traffic Injury Prevention*.

Goodwin, A. H. 2004. A social norms approach to reduce drinking-driving among university students. Glasgow, Scotland: *Proceedings of the 17th International Conference on Alcohol, Drugs and Traffic Safety.*

Goodwin, A. H., M. W. Waller, R. D. Foss, and L. H. Margolis. 2006. Parental Supervision of Teenage Drivers in a Graduated Licensing System, *Traffic Injury Prevention* 7 (3): 224–31.

Hedlund, J. H. 2006. Countermeasures that work: A highway safety countermeasures guide for state highway safety offices. Washington DC: *National Highway Traffic Safety Administration*. DOT HS 809 980 (January).

Jones, E. E., D. E. Kanouse, H. H. Kelley, R. E. Nisbett, S. Valins, and B. Weiner. 1972. *Attribution: Perceiving the causes of behavior.* New York: General Learning Press.

Kallberg, V. P. 1993. Reflector posts—signs of danger? *Transportation Research Record* 1403:57–66.

Kreitner, R., and A. Kinicki. 2004. *Organizational Behavior* (6th ed.). New York: McGraw-Hill.

Lacey, J. H., R. K. Jones, and J. C. Fell. 1996. Effectiveness of the "Checkpoint Tennessee" program. *40th Annual Proceedings of the Association for the Advancement of Automotive Medicine* 275–82.Des Plaines, IL

Marrow, A. J. 1969. *The practical theorist: The life and work of Kurt Lewin*. New York: Basic Books.

National Committee for Injury Prevention and Control. 1989. Injury prevention: Meeting the challenge [supplement to *American Journal of Preventive Medicine* 5 (3)]. Oxford University Press, New York.

Norenzayan, A., and R. E. Nisbett. 2000. Culture and causal cognition. *Current Directions in Psychological Science* 9:132–5.

Perkins, H. W. 2003. *The social norms approach to prevention school and college age substance abuse: A handbook for educators, counselors and clinicians*. San Francisco: Jossey-Bass.

Pinel, J. P. J. 2007. *Basics of Biopsychology.* Allyn & Bacon.

Reinfurt, D. S. 2004. Documenting the sustainability of a mature Click It or Ticket program: the North Carolina experience. *Journal of Safety Research* 35:181–8.

Reyna, V. R. 2004. How people make decisions that involve risk. A dual-processes approach. *Current Directions in Psychological Science* 13:60–66.

Ross, H. L. 1982. *Deterring the drinking driver: Legal policy and social control*. Lexington, MA: Lexington Books.

———. 1991. Decriminalizing drunk driving: A means to effective punishment. *Journal of Applied Behavior Analysis* 24:89–90.

Shibutani, T. 1966. *Improvised news: A sociological study of rumor.* The Bobbs-Merrill Company.

Sivak, M. 2002. How common sense fails us on the road: Contribution of bounded rationality to the annual worldwide toll of one million traffic fatalities. *Transportation Research* (Part F) 5:259–69.

Stokols, D., and I. Altman, eds.1987. *Handbook of Environmental Psychology.* New York: Wiley.

Triandis, H. C. 1994. *Culture & social behavior.* New York: McGraw-Hill.

Williams, A. F. 2004. Reflections on the highway safety field. *Injury Prevention* 10 (6): 330–3.

Zaza, S., D. A. Sleet, R. S. Thompson, D. M. Sosin, and J. C. Bolen. 2001. Task Force on Community Preventive Services (2001) Reviews of evidence regarding interventions to increase use of child safety seats. *American Journal of Preventive Medicine* 21 (4 Suppl): 31–47.

Biographical statement

Robert Foss, a Social Psychologist, is a Senior Research Scientist at the University of North Carolina Highway Safety Research Center where he heads up the Center for the Study of Young Drivers. After early inquiries into group decision making and altruistic behavior, he turned to research on behavioral issues and the role of policy in traffic safety in the mid-1980s, focusing primarily on factors contributing to young driver crashes and the role of alcohol in injury risks. He and his research team designed the North Carolina and Delaware Graduated Driver Licensing systems and have assisted several other states in formulating their GDL programs. They have continued to study young driver crashes—leading to the addition of a passenger restriction to the North Carolina GDL program—and the long term effects of graduated licensing programs. They have conducted numerous surveys of both parents and teens to learn about their experiences with this new approach to young driver licensing and to determine how a better understanding of the parent-teen relationship might be used to further reduce crashes. In the past decade, Foss and his team have also developed and implemented multiyear studies to examine college-student drinking using direct measurement of breath alcohol concentration (BAC), to evaluate a social psychologically based program (correcting misperceptions of social norms regarding drinking by college students) to reduce drinking. They also used directly measured BACs to determine the shape of the risk curve for fatalities resulting from drinking among recreational boaters and have examined the effects of various drinking-driving laws, the role of alcohol in child traffic fatalities, and the effects of bicycle helmet laws.

The perceived legitimacy of intervention:
A key feature for road safety

Frank P. McKenna

Department of Psychology
University of Reading
and Perception and Performance

Overview

It is argued that sufficient is known about the broad causal factors underlying crashes to prompt action. The challenge for society has been and remains whether we are prepared to take action to reduce casualties. There are key philosophical arguments and psychological processes at the heart of this debate. Given that these arguments and these psychological processes operate as the gatekeepers to action, it is argued that they merit more attention than they have received. The paper provides an examination of the "harm principle," which has been employed to limit paternalistic interventions. More generally, the perceived legitimacy of intervention is examined, and then the specific case of speeding is considered.

Introduction

Across the world, road crashes are responsible for the deaths of more people below the age of forty than any other factor. It is clear that road safety is a major issue for public health. Unlike some areas of public health, where the major challenge is to identify the underlying causal agents, I will argue that the major causal agents in the case of road crashes are known. The main challenge then is whether society is prepared to intervene. It will be argued here that some of the major factors that have reduced casualties, such as the introduction of speed limits, drunk driving laws, seat belt laws, motorcycle helmet laws, many traffic engineering schemes, and graduated licensing, have all involved a restriction on individual liberty. A question then arises as to whether interventions are perceived as legitimate.

Historically, this issue of perceived legitimacy has proved to be a barrier for many key safety measures and has played an important role in determining whether interventions are implemented, when they are implemented, and, finally, the level of support they receive, even if they are implemented. As an example of the latter, we might consider driving while intoxicated. Waller (2001) noted that in the past, drunk driving was regarded as a "legitimate" practice, even though it was illegal. She noted that defendants would ask for a jury trial because "juries almost invariably acquitted the defendant" (p. 3). Waller argued that it was the intervention of citizen-action groups that changed public policy. In the terms used here, the perceived legitimacy of drunk driving changed so much so that the casual indifference to drunk driving was replaced by the perception that drunk driving is an antisocial act. As the perceived legitimacy of the act changed, so also did the perceived legitimacy of intervention. It became acceptable for the police to take active steps to detect and deter drunk driving. It became possible to introduce *per se* laws, in which it was no longer necessary to prove that a person was unfit to drive; the sheer presence

of sufficient alcohol was grounds for prosecution. A very large shift in the perceived legitimacy of the activity has taken place.

Perceived legitimacy is important across a spectrum of public health policy. Consider the role of tobacco. In the past, smoking cigarettes was regarded not only as legitimate but also a social activity. High-status individuals such as movie stars were frequently portrayed smoking, and the activity itself was social with individuals passing cigarettes around. Over the years, the perceived legitimacy has changed so much so that it now attracts laws banning the activity in public places as well as work places. Two features are worthy of note. The first is that the perceived legitimacy of an activity and the perceived legitimacy of an intervention can have a major role to play in public health. Second, the perceived legitimacy of an activity is not static and can change remarkably over the years. What would have not been perceived as legitimate at one point in time (e.g., banning smoking in work places) can become commonplace some years later. Again, we see that large changes in the perceived legitimacy of an activity are associated with major shifts in intervention. Twenty-five years ago banning smoking on a large scale across pubs, restaurants, and work places would have been regarded as an impractical option.

The point about this analysis is that we need a greater understanding of the processes underlying the perceived legitimacy of activities and intervention. At a philosophical level, we need to understand the arguments for and against state intervention. At a psychological level, we need to understand the factors underlying these perceptions of legitimacy and the processes that result in shifts in perceived legitimacy.

Philosophy can seriously damage your health

There are some important philosophical arguments that have been integral to the acceptance and rejection of major safety campaigns and, hence, their perceived legitimacy. Waller (2001) noted that seat belt legislation in the USA was initially rejected out of hand by legislators on the basis of an infringement of personal liberty. In the UK, seat belt legislation came before parliament many times before it was passed. The argument against seat belt legislation was again that it was an unacceptable infringement of freedom. A similar debate arose when considering the requirement that motorcyclists wear helmets.

The fundamental question at stake is what power should a state have to restrict the autonomy of individuals. One principle that is widely advocated is the “harm” principle. John Stuart Mill (1859/1909) elucidates:

> *“That principle is, that the sole end for which mankind are warranted, individually or collectively in interfering with the liberty of action of any of their number, is self-protection. That the only purpose for which power can be rightfully exercised over any member of a civilized community, against his will, is to prevent harm to others. His own good, either physical or moral, is not a sufficient warrant. He cannot rightfully be compelled to do or forbear because it will be better for him to do so, because it will make him happier, because, in the opinion of others, to do so would be wise, or even right.”*

This principle has implications for a wide range of safety measures. For example, it has been argued that the case for legislation for both seat belts and motorcyclist helmets fails the "harm" principle test. In both cases, the contention is that no harm is caused to others, that any harm that results does so only to the individual in question. Because the only person adversely affected by the decision is the individual in question, then no intervention is justified. In the face of such a strong argument, one might query why so many governments have failed to apply this principle. The application of this principle can protect a whole range of basic freedoms, such as the freedom to practice one's religion and freedom of speech. In addition, this principle has a direct impact on whether safety laws are passed or repealed, and that, in turn, has a direct consequence for death and injury. (As Leichter 1991 noted, there was no real question that a seat belt law would save lives; rather, the question was one of restriction of liberty.) Some commentators (e.g., Smith 2002) have noted that this argument can be used to support the legalization of illegal drugs. Again, the defense is that the use of illegal drugs may provide a harm to the self but not to others. The stakes are high.

One might distinguish between those aspects of this principle that provoke little debate from those that are more contentious. For example, there is little controversy over the proposal that doing harm to others provides a legitimate argument for intervention. What is more contentious is the proposal that harm to others is the only justification for restricting freedom. Where a behavior such as drunk driving demonstrably causes harm to others, then the philosophical case for intervention is uncontroversial. (The challenge of persuading the community and politicians that action is not only warranted but should take place may, of course, remain.) A case where the introduction of the harm principle was associated with greater pressure for intervention would be the use of tobacco. The case for smoking restrictions became less controversial when passive smoking became an issue. In other words, if smoking causes harm to others, then restrictions on this liberty become legitimate.

Other aspects of the harm principle provoke more debate. It is clear that freedom is highly valued. For example, in arguing against seat belt legislation, Senator Kent Pullen stated, "There is something more important than life itself, and that's freedom."(cited by Leichter 1991, 12) While this statement reflects effective rhetoric, one might take issue with the argument. The state of freedom is reversible while death is not. It is not entirely clear what freedoms can be exercised when dead. If one's freedom to wear a seat belt has been denied, at least one can exercise a great many other freedoms. Interestingly, one aspect that has provoked little discussion is the distinction between different types of freedom. Would prohibiting the freedom to ignore the seat belt be the same as prohibiting the practice of your religion or freedom of speech. If these are not equivalent, then on what basis are they not equivalent? One difference is whether the activity has direct links to core values. It is easy to see that prohibiting the practice of one's religion is more likely to strike at a core value than putting on a seat belt. Restricting a freedom that is linked to a core value is liable to have an extensive impact on a person. By contrast, restricting the freedom of choice over wearing a seatbelt does not even have an impact on where or how the vehicle is driven. Too often, freedom is discussed as a binary attribute being present or absent with no indication of the consequences of such a restriction. The proposal made here is that where it is planned to limit freedom, more careful discussion of the type of restriction and consequences of the restriction should be made. For those of us who are concerned to defend our freedoms, we need to take on board that some people will die not in the defense of that freedom but as a consequence of that freedom. We need to be sure that their lives are worth that very specific type of freedom. All freedoms are not equal. If in an area of high unemployment (and, hence, my choice is restricted) my employer insists that I wear a shirt and tie, should I invoke the harm principle

arguing that my freedom is inappropriately being curtailed? Is wearing a shirt and tie more or less restricting than using a seat belt?

The harm principle is designed as a protection against paternalistic intervention. Such interventions undermine autonomy by overriding personal choice. The paternalistic defense is that people do not know what is in their best interest, whereas Mill's harm principle does suppose that people do know what is in their best interest. Thaler and Sunstein (2003) and Kahneman (2003) argue that this is an empirical question and that the answer is that people do not know what is in their best interest. If this is true, then authorities are presented with a dilemma in that there are strong arguments for leaving people to their own devices and that when this happens people do not operate in their own best interest. One important factor may be whether road users are fully informed and properly evaluate the relative costs and benefits of their behavior. Are drivers, for example, fully informed on their relative skills, and do they apply appropriate weight to the potential health threat of crash involvement. McKenna (in press) reports that only 4% of drivers consider themselves less skillful than average, and the majority perceive that they are less likely than others to be involved in a crash (McKenna 1993). In exploring the factors associated with risk taking, McKenna and Horswill (2006) noted that while perceived health threat might be expected to be a major factor, this was not found to be the case. Overall, it is entirely possible that road users are not operating as fully informed decision makers in the way that the harm principle would presuppose.

There are other reasons for questioning the application of the harm principle that relate to the fact that humans operate as social beings. Opposition to all forms of intervention would be more readily supported, as we shall see, if people led more autonomous self-reliant lives.

Humans as social beings

The philosophical and political framework for much debate on the harm principle and the legitimacy of intervention assumes that the individual is operating in a social vacuum. It might seem obvious to state that individuals do not live much of their lives as autonomous agents in isolation. From eating breakfast that has not been personally grown, to work that is dependent on others, to our house that has been built by someone else, to family commitments, most of our experience is dependent on others. This vast network of interdependence comes with considerable benefits, but there are consequences for autonomy. If many individuals choose to exercise their autonomy by engaging in the same activity, then negative consequences can occur. At a trivial level, if we all walk on the same bit of grass, then there will be no grass. At a less trivial level, Hardin (1968) in a classic paper "The tragedy of the commons" notes the consequences of freedom. He describes the freedom of each individual to increase the number of cattle grazing on the commons. Although more cattle on the commons means more overgrazing, this is a cost that is shared by all, whereas each additional animal produces a personal benefit. As a result, it is in the best interest of each individual to increase the number of cattle despite the overgrazing. He concludes that "Freedom in a commons brings ruin to all" (p 1244). It is easy to see how the argument can be applied to a wide spectrum of behavior including fishing, pollution,

and the population. For example, if we all exercise our freedom to fish in the same pond, then there will be no fish for anyone. Each individual increment produces no discernible harm, but the accumulated actions can produce devastatingly negative effects for all. Hardin argues that we must restrict our freedoms. Callahan (1996), in a different context, argues that we implement the *ecological principle*, that prior to supporting autonomy, we examine the likely aggregate effect of individual choices. Overall, the argument is that for a complex society unconstrained freedom is unworkable.

It might also be added that in a highly interrelated network of social relationships it is quite difficult to determine a harm that has only consequences for the individual in question. Let us consider a legal objection to the mandatory use of motorcyclist helmets in the US. The objection took the form of the harm principle, arguing that restrictions should not be imposed when the harm occurred only to the self. The court ruling did not support the harm principle with the key point being cited by Leichter (1991, 187), as follows:

> *"From the moment of the injury, society picks the person off the highway; delivers him to a municipal hospital and municipal doctors; provides him with unemployment compensation if, after recovery, he cannot replace his job, and, if the injury causes permanent disability, may assume the responsibility for his and his family's subsistence. We do not understand a state of mind that permits plaintiff to think that only he himself is concerned."*

A point not generally noted but described by Tauber (2003, 490) is that "Autonomous choices bequeath responsibility for those choices." If I make a choice, can I support the full consequences of that choice? If I suffer brain damage as a consequence of failing to wear a helmet, I may a) be unable to support myself and b) my condition may have major (harm?) consequences for a family member who feels obliged to look after me. In other words I have been unable to take full responsibility for my choice.

Restrictions on freedom may well be a natural function of our status as social beings. For example, there are no good reasons for driving either on the left or the right. An equally good case could be made for either. What is critically important is that we deny ourselves the freedom to do one. Another example would be compulsory purchase. If I own a house that is on the site of a major development, I may find that my freedom to retain my own house is denied in the interests of the common good. The very complexity of the network of relationships among people means that constraints are placed on our freedoms.

A more subtle, but nonetheless compelling, argument concerning the social nature of decision making was noted by Schelling referring to the fact that historically in hockey it was not required that all players wear a helmet. Schelling (1972, 1) quoted one player who explained why the players themselves did not voluntarily choose to wear them: "It's foolish not to wear a helmet. But I don't because the other guys don't. I know that's silly, but most players feel the same way. If the league made us do it, though, we'd all wear them and nobody would mind." From research on conformity, we know how readily judgment is shifted by other people. If a potentially dangerous social context develops (e.g., speeding, smoking), then powerful social constraints

will be in place. Ajzen (1991) has noted that what individuals believe to be the norm has an important impact on their intentions.

Perceived legitimacy—the case of spending

Up till now we have considered cases in which the arguments are well rehearsed. It is interesting to apply the arguments to a case that is rather less developed. Speeding represents an important challenge for most societies. The relationship between speed and casualties is well documented and in professional circles is uncontroversial (e.g., Aarts and van Schagen 2006; Finch et al. 1994; Richter et al. 2006). It follows then that speed-control interventions will be effective (e.g., Hirst et al. 2005). While there is a general consensus on the role of speed among the scientific community this, of course, does not imply that the driving public necessarily agree either about the relationship between speed and casualties or in the legitimacy of intervention. Interestingly, it is not likely that the harm principle will be effective in defending speeding. It is implausible to argue that those traveling at inappropriate speeds manage to harm themselves without harming their passengers, pedestrians, or other vehicle users. Hence, the harm principle would support intervention.

One difficulty that might emerge is in the type of causal hypothesis that people have about the relationship between speed and crash involvement. Those who wish to oppose a relationship between speed and crash involvement might reasonably argue that faster speeds do not in each and every case of necessity produce a crash. By contrast, the scientific community have in mind a probabilistic association in which the average crash involvement increases with the average speed. Those who have a discomfort with a probabilistic model might note that the same argument would apply to drinking and driving. The use of alcohol does not in each and every case of necessity produce a crash, but the general reduction in drunk driving will produce a reduction in casualties.

If there are no fundamental philosophical problems in intervening in the case of speeding where then might a problem emerge from? One interesting problem might emerge from the sheer frequency of violations. For example, in one large survey it was found that 69% of cars exceeded the 30 mph speed limit on urban roads (DETR 2000). It is fairly clear that the law is broken on a massive scale. This in itself poses a problem for public policy. What mandate do authorities have for prosecuting the majority of the population that they represent? At this point, it may be easier for some communities to endure the casualties than face the challenge. The costs of doing nothing are, however, very high.

Why do drivers speed?

Before addressing the issue of how to change the perceived legitimacy of speeding and speeding interventions, it might be worth considering the justifications that people offer in the first place. Gabany et al. (1997) provided an analysis of reasons that people offered for breaking the speed limit. Three coherent factors emerged—these being 1) thrill, 2) time pressure, and 3) inattention. These factors were generated by people making judgments about the reasons why others might break the speed limit. They were not generated by people making judgments about why they themselves broke the speed limit. In an analysis of the latter, McKenna (2005b) asked people

who had broken the speed limit what factors were operating at the time they broke the speed limit. It was found that for 96% of drivers, thrill had little impact on their speeding offense. It was also found that for 67% of drivers, time pressure had little impact on their speeding offense. In a more recent analysis, I find that about 50% of drivers admit that they were paying little attention to the speed limit at the time of the offense. Importantly, there is little instrumental value in breaking speed limits either in terms of thrill or time pressure. Inattention would appear to be a more important factor. It would appear that the default speed that emerges from the combination of the person, the vehicle, and the road is too high. The fact that there is little perceived gain in breaking the speed limit is interesting because it suggests that there may be less instrumental self-interest barriers than might have been supposed.

Addressing the perceived legitimacy of speeding

From our limited understanding, what policy advice might be offered to those who wish to address the perceived legitimacy of speeding and speeding interventions. One important issue would be where to start? Should one start to challenge beliefs about the legitimacy of speeding where they are most strongly held or where they are least strongly held? Of course, it would be an empirical matter to determine the strength of attitudes in different situations. Given the historically high acceptance of speeding, it might be worth garnering some support from those situations where the perceived legitimacy of speed control might be highest. One might speculate, for example, that speeding in the vicinity of schools is not liable to be met with much approval. In Scotland, a program has been implemented to introduce lower speed limits at the times that children are entering and leaving the school. It would be hypothesized (and easy to test empirically) that this type of speed control intervention might be perceived as legitimate. Providing a series of incremental shifts in the perceived legitimacy of speeding would eventually undermine the subjective norm that speeding was acceptable.

Harm principle

Given the importance of the harm principle in public policy, it inevitably will play a role in the perceived legitimacy of speeding. (Although we have noted that there are limitations to the harm principle as the *sole* argument for limiting behavior, it remains a powerful argument in favor of the legitimacy of intervention.) It would be hypothesized, therefore, that the application of the harm principle would produce a shift in perceived legitimacy. In other words, providing a voice for those who are victims of crashes involving speeding drivers would produce a shift in the perceived legitimacy of speeding. There is another societal role for those at the unfortunate end of the harm principle. It will be recalled that Waller (2001) judged that citizen action groups played a key role in changing public policy on drunk driving. The hypothesis here is that a change in public policy may require not only a shift in perceived legitimacy but also a shift in the motivation to see policy change.

It is proposed then that any campaign to change the perceived legitimacy of speeding would rely heavily on the consequence for innocent parties. In addition, the greatest motivation for change and the greatest understanding for the need for change is most likely to come from those who

have suffered. (It might also be noted that while citizen action groups may provide the motivation for change, they may not be best suited to direct policy unless they are well informed.) Interestingly, on the specific issue of the harm principle, speeding is less challenging than either seat belts or motorcycle helmets. The challenge in addressing speeding is the sheer numbers of people who break the law and the culture of indifference associated with the behavior. (Here one might see an analogy with smoking and a how perceptions of that behavior changed over time.)

Education

The role that education can play in perceived legitimacy can be pivotal and rather different from the traditional educational role. Educational programs are often assessed against a criterion of whether they directly change crash involvement and often can be considered a failure because no direct change is forthcoming. Supporters of evidence-based policy who use crash involvement as their criterion would then wish these programs to be ended. That conclusion does not follow from the present analysis. The approach advocated here is that many education programs should be seen in a different light, with the aim of changing the perceived legitimacy of action. The proposal is that some interventions for example, safety legislation, enforcement programs, and even engineering measures could not occur in the absence of shifts in the perceived legitimacy of action. In other words many educational programs should be seen in the context of perceived legitimacy and assessed accordingly. (It might be added that many educational programs would best be designed with this goal in mind.) In principle, the proposal is that it would be possible for an educational program simultaneously to have no direct effect on public health but to have a fundamental indirect effect. For example, an educational program could enable the implementation of enforcement programs, legislation, etc. that would otherwise have no chance of implementation. In the UK, it was only following extensive educational campaigns on seat belts that legislation was passed. Without successful educational campaigns to support the legitimacy of intervention, it is entirely possible that interventions will fail to be implemented or withdrawn. Speeding interventions may be a case in point. For example, Delaney et al (2005) note that following lobbying by interest groups an automated speed enforcement program in British Columbia was terminated.

An important role of education is, of course, that it facilitates informed decision making. Education on speeding provides an interesting range of challenges including the requirement that people understand that energy does not increase linearly with an increase in speed. This point underlines a number of campaigns in the UK and in Australia. For example, in one campaign the message is that at 35 mph you are twice as likely to kill a pedestrian than at 30 mph. The message presented is that what appears to be a trivial breach of the speed limit can quite literally be the difference between life and death. These messages may or may not have an impact on driving behavior, but their primary aim (in my view) is to change the perceived legitimacy of speed control. If perceived legitimacy is shifted, then speed control by enforcement, engineering, etc. becomes possible.

Perceived fairness of enforcement

If the starting point of an enforcement campaign is that the majority of people break the law, then there is extra pressure on the procedures used for enforcement. The very fact that an informal

term “speed trap” is used presupposes that at least some members of the public consider the enforcement to be unfair. One would hardly refer to other police action as a “burglary trap” or a “vandalism trap”. One method of addressing this issue is to emphasize deterrence rather than detection. If speed-related casualty sites are identified, then a) enforcement can be applied to those sites where casualties are highest and b) drivers can explicitly be warned that enforcement may take place. Two aims can then be realized. First, to be transparent that the goal is to reduce casualties, not increase revenue (see the later section on trust). Second, there is transparency that the aim is to produce a reduction in speed without necessarily prosecuting large numbers of speeding drivers.

In criminology, deterrence theory proposes that increased deterrence will follow from increases in punishment severity, celerity (imminence), and certainty. However, as Nagin and Pogarsky (2001) note, there is sound empirical support only for certainty. For example, when the effect of severity has been examined, the conclusion has been that there is no association between the severity of punishment and level of crime in society (Doob and Webster 2003). These results have important implications for police enforcement which historically has been characterized by levels of detection certainty that are probably too low to deter. By focusing enforcement efforts on casualty sites, the certainty of detection can be increased to levels that will deter. By warning drivers of the presence of enforcement, the aim is to provide the driver with every opportunity to change behavior. If the enforcement is transparent and warnings have been presented, then it is hard for the offending driver to claim that the procedure is unfair. In many countries, an increasing proportion of speed enforcement takes place through automated safety cameras. The economic costs of safety cameras are considerably less than traditional enforcement and 24-hour enforcement is readily achieved. By making the cameras highly visible and preceding the camera with warning signs, the above principles are readily implemented. One potential limitation of the approach outlined is that the public may interpret the program as one in which their law breaking is limited within specific locations and outside of these they may break the law with impunity. The alternative possibility is that drivers may slowly generalize their reduced speeds to other roads. The issue is an empirical matter. In tracking free-flowing speeds at unenforced sites, it has been observed that the percentage breaking the speed limit has shifted from 70% in 1998 to 50% in 2005 (Department for Transport 2006). It would appear, therefore, that the overall program is achieving some success.

While some sections of the media have considered the above procedures controversial, there is little evidence that the public do so (Gains et al. 2005). While policy makers often monitor the media for indications of public concern, they would be well advised to monitor public opinion directly. Poulter and McKenna (2007) examined public concern for a whole range of antisocial behaviors. They found that concern over speeding was now significantly greater than any other antisocial behavior.

A general difficulty in changing the perceived legitimacy of speeding is the sheer frequency of the offense. As Nagin (1998) has noted, it is difficult for an offense to be socially isolating if it is commonplace. One additional tool that can be employed is the use of speed awareness courses. Drivers are offered the opportunity to pay for their speed awareness course as an alternative to punishment. There are a number of characteristics of these courses. As noted, they are self funding and, as such, do not place a burden on the public purse. Unlike the delivery of most safety messages, they are targeted at people who, by definition, most need to attend to the message. It was noted earlier that the majority of drivers have an overly optimistic view of their driving. Some courses provide a personal driver risk profile to each driver so that they can eval-

uate their own personal risk (McKenna 2004). It has been found that the course is effective in changing the perceived legitimacy of speed control (McKenna 2005a). It might also be added that speed awareness courses are a method by which speed control can be implemented at speeds rather closer to the speed limit. It is not uncommon for police forces to enforce at levels that are considerably higher than the speed limit. The dilemma that police forces face is that if they enforce at speeds way above the limit, they provide a reinforcement schedule that may inadvertently support and maintain high speeds. If they enforce at speeds closer to the limit, they risk strain on public acceptability. Speed awareness courses provide a compromise.

Trust

A key feature in the perceived legitimacy of interventions is trust in the motivation of authorities. If the public suspect the motives of authorities, then trust is sacrificed. In the realms of speed enforcement, the major challenge that authorities must face is the accusation that enforcement is there for revenue generation rather than to reduce casualties. As Delaney et al. (2005) have noted, if there is concern that enforcement is taking place that is designed purely to make money rather than as a safety measure, then trust will inevitably be undermined. Speed awareness courses can play a part because the finance paid goes to their own training course. The issue of trust has implications for where and how enforcement takes place. It also has implications for ensuring that appropriate, transparent, and readily understood speed limits are in place.

Summary and recommendations

Sufficient is known about the magnitude of the injury problem and the broad underlying causal factors to prompt action. However, there are powerful constraints on societal intervention. Here we have examined one powerful philosophical constraint, the “harm principle,” and noted the limitations of this argument as the sole determinant of societal intervention. More generally, it is argued that the perceived legitimacy of action and intervention has played an important role historically in public health and can be expected to play an important role in the future. This role has been played with insufficient explicit attention being drawn to the psychological processes involved. It is proposed that the issue of perceived legitimacy be addressed directly. By way of illustration, the question of speed control is examined. It is known that speed is associated with casualties and a range of countermeasures are available. Their implementation, however, is significantly influenced by the perceived legitimacy of intervention. Indeed, technological developments are so well advanced that they can provide the driver with not only feedback on whether the vehicle is breaking the speed limit but also can provide complete control of the vehicle. The major challenges are not technical. We need to understand the factors that promote and undermine perceived legitimacy. This approach casts new light on the examination of potential safety proposals and the role of many education programs. For example, while education measures are often assessed in terms of their direct effects on behavior and crash involvement, the proposal made here is that they may also be interpreted in terms of their indirect effects via the perceived legitimacy of action and intervention. It is noted that the perceived legitimacy of action can change considerably over time and interventions that would not be perceived as legitimate at one point in time may be considered uncontroversial at a later point in time.

References

Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50:179–211.

Aarts, L., and I. van Schagen. 2006. Driving speed and the risk of road crashes: A review. *Accident Analysis and Prevention* 38:215–24.

Callahan, D. 1996. Can the moral commons survive autonomy. *The Hastings Center Report*, 41–42.

Delaney, A., H. Ward, and M. Cameron. 2005. *The history and development of speed camera use*. Monash University Accident Research Centre, Report No. 242.

Department for Transport. 2006. *Transport statistics bulletin: Vehicle speeds in Great Britain 2005*. Department for Transport: London, UK.

DETR. 2000. *New directions in peed in speed management: A review of policy*. Department of the Environment, Transport and the Regions: London.

Doob, A. N., and C. M. Webster. 2003. Sentence severity and crime: Accepting the null hypothesis. In M. Tonry, ed. *Crime and Justice: A Review of Research* 25:143–95. Chicago: University of Chicago Press.

Finch, D. J., P. Kompfner, C. R. Lockwood, and G. Maycock. 1994. *Speed, speed limits and crashes*. Project Record S211G/RB/Project Report PR 58, Transport Research Laboratory TRL. Crowthorne, Berkshire.

Gabany, S. G., P. Plummer, and P. Grigg. 1997. Why drivers speed: The speeding perception inventory. *Journal of Safety Research* 28:29–36.

Gains, A., M. Nordstrom, B. Heydecker, and J. Shrewsbury. 2005. *The national safety camera programme: four year evaluation report*. Department for Transport.

Hardin, G. 1968. The tragedy of the commons. *Science* 162:1243–8.

Hirst, M., L. J. Mountain, and M. J. Maher. 2005. Are speed enforcement cameras more effective than other speed management measures? An evaluation of the relationship between speed and accident reduction. *Accident Analysis and Prevention* 37:731–41.

Kahneman, D. 2003. A psychological perspective on economics. *American Economic Review* 93:162–8.

Leichter, H. M. 1991. *Free to be foolish*. Princeton University Press: Princeton New Jersey.

McKenna, F. P. 1993. It won't happen to me: Unrealistic optimism or the illusion of control or? *British Journal of Psychology* 84:39–50.

———. 2004. The Thames Valley Speeding Awareness Scheme: A comparison of high and low speed courses. *Behavioural Research in Road Safety*, 14: Department for Transport. http://www.perceptionandperformance.com/pdf/McKenna%20Department%20for%20Transport%202004.pdf.

———. 2005a. What shall we do about speeding—Education? In G. Underwood. *Traffic & Transport Psychology*. Amsterdam: Elsevier

———. 2005b. Why do drivers break the speed limit? In *Behavioural Research in Road Safety* 15. Department for Transport. http://www.perceptionandperformance.com/pdf/behav05paperweb.pdf.

———. (in press). Human factors in road traffic accidents. In Ayers et al., eds *Cambridge Handbook of Psychology, Health and Medicine* 2nd Edition. Cambridge UK: Cambridge.

McKenna, F. P. and M. S. Horswill. 2006. Risk taking from the participant's perspective: The case of driving and accident risk. *Health Psychology* 25:163–70.

Mill, J. S. 1859/1909. *On Liberty.* Harvard Classics.

Nagin, D. S. 1998. Criminal deterrence research at the outset of the twenty-first century. *Crime and Justice* 23:1–42.

Nagin, D. S., and G. Pogarsky. 2001. Integrating celerity, impulsivity and extralegal sanction threats into a model of general deterrence: Theory and evidence. *Criminology* 39:404–30.

Poulter, D., and F. P. McKenna. 2007. Is speeding a "real" antisocial behavior? A comparison with other antisocial behaviors. *Accident Analysis and Prevention* 39:384–9.

Richter, E. D., T. Berman, L. Friedman, and G. Ben-David. 2006. Speed, road injury, and public health. *Annual Review of Public Health* 27:125–52.

Schelling, T. C. 1972. *Hockey helmets, concealed weapons and daylight saving: A study of binary choices with externalities*. Discussion paper no. 9. Public Policy, Program, John F. Kennedy School of Government, Harvard University.

Smith, P. 2002. Drugs, morality, and the law. *Journal of Applied Philosophy* 19:233–44.

Tauber, A. I. 2003. Sick Autonomy. *Perspectives in Biology and Medicine* 46:484–95.

Thaler R. H., and C. R Sunstein. 2003. Libertarian Paternalism. *American Economic Review* 93:175–9.

Waller, P. F. 2001. Public health's contribution to motor vehicle injury prevention. *American Journal of Preventive Medicine* 21:3–4.

Biographical statement

Dr. Frank McKenna obtained a B.Sc. from the University of Glasgow, a Ph.D. from University College London after which he spent six years at the Cambridge Medical Research Council Applied Psychology Unit. He is also a Professor of Psychology and has spent the last 25 years carrying out research on driver behavior and crash involvement and has published extensively on the topic. He is on the editorial board of the international journal Accident Analysis and Prevention. He is a member of the Parliamentary Advisory Council for Transport Safety and sits on the advisory board for both ROSPA and the AA Foundation for Road Safety (now the AA Motoring Trust). He is a director of the company Perception and Performance. He has provided safety advice to the UK government and other countries on a number of topics.

Creating a Total Safety Traffic Culture

Chris S. Dula

East Tennessee State University

E. Scott Geller

Virginia Tech

Overview

For more than two decades, Geller and associates have used the concept of a *Total Safety Culture* to create significant and lasting safety improvements in a variety of industrial contexts. In a Total Safety Culture, the organization's members feel responsible for regularly identifying and acting on safety-related objectives, many going "beyond the call of duty" to address unsafe conditions and behaviors. This paper addresses the application of the Total Safety Culture notion to traffic safety issues and discusses the creation of a Total Safety Traffic Culture. Behavior-based safety, an actively caring model, and the benefits of using positive reinforcement are highlighted. Catalysts and barriers to a cultural shift are considered throughout, as is the need to teach basic behavioral-science methods throughout our culture.

The ideas offered herein can be used to identify specific problem targets, customize and validate intervention designs, derive relevant outcome measures, and demonstrate successive progress while traffic safety goals are continuously selected and achieved. Additionally, these behavior-change methods are easy to teach and use, inexpensive to execute, self-sustaining, and thus, are practical for large-scale application. Using locally informed, nationally endorsed, and socially valid interventions, an individualized approach to traffic safety can transform society's traffic safety orientation, bringing about an interdependent safety culture where everyone helps to prevent the tragic consequences of vehicle crashes.

Introduction

> *Every year this country experiences a national tragedy that is as preventable as it is devastating.—Norman Y. Mineta* (NHTSA 2006).

Consider the social upheaval that arose, and rightly so, following the tragic attacks on the U.S. on September 11, 2001. The deaths of nearly 3,000 people in those attacks spurned: a) the creation of the new Cabinet-level Department, b) the passing of vast amounts of security-related legislation, c) military action involving the deployment of hundreds of thousands of troops with the death of over 3,000 U.S. soldiers and many more wounded at the time of this writing, and, d) the projected spending of nearly $500 billion on related military operations by the end of 2007 (Department of Defense 2006a, 2006b; Belasco 2006). Perhaps more profoundly, Americans have been willing to debate and change definitions of democracy and freedom to bring the threat of terrorism under control.

With great reverence, and simply by way of comparison to this historic shift in public consciousness, we ask the following question: Why have the crash-related deaths of approximately 200,000 people and injuries of roughly 15 million in the five years since 9/11 not generated the same sense of outrage and calls for sweeping action to protect citizens? Why are we not incensed over our tremendous losses from traffic crashes?

The answer is both simple and complex. The simple answer is complacency, but reasons for this complacency are complex. Probably few are truly at peace with these grim facts about driving dangers, but the main question for most is: "What can I do about it?" When you get right down to it, traffic safety is largely the responsibility of individual drivers. But, viewing collective risk from a national perspective, the dramatic numbers make the problem appear unsolvable.

For more than two decades, E. Scott Geller and colleagues have taught organizations how to achieve a Total Safety Culture and, more recently, documented how to apply psychological science to promote human welfare on a large scale (e.g., Geller 1989, 1991, 1994, 1995, 2000, 2001a, 2001b; 2002, 2003a, 2005a, 2005b, 2005c; Geller et al. 1998; Geller and Roberts 1993; Geller, Roberts, and Gilmore 1996; Porter 1998; Roberts and Geller 1995). The Total Safety Culture approach applies *behavior-based safety* (BBS) principles and an Actively Caring model, both theory-based and research-supported, to shift industrial cultures from risk-tolerant to risk-averse and from reactive to proactive in the pursuit of safety in all areas of operation.

The BBS approach includes a set of tools and methods that includes defining safe and at-risk behaviors, observing and recording related behaviors, giving feedback in a supportive manner, charting progress, and using data to motivate or celebrate accomplishments and to revise behavior-based goals. The Actively Caring model supports the use of BBS and consists of showing concern for others with behavior aimed at reducing risks. This model takes into account person states and barriers to helping, explains who is likely to demonstrate actively caring, and pinpoints the conditions that facilitate helping.

While generally not a replacement for punishment approaches, the use of positive reinforcement in safety interventions is stressed, as its efficacious use is supported by research. Related to BBS and actively caring, a People-Based Safety™ perspective stresses the need to keep people's cognitions (thoughts, attitudes, and beliefs) and feelings at the forefront of any attempts to influence safety-related behavior. The benefits of these approaches, were they to be used universally, are virtually unlimited and have the added advantage of being straightforward and economical to teach, learn, and use. In addition, their application would be acceptable to most people.

The Total Safety Culture process takes a by-the-people-for-the-people approach, teaching employees what they need to know about behavioral science methods to produce positive safety outcomes in their own corner of the world. There is an explicit assumption: The "…more individuals participating in a safety-improvement process and the greater the rate of process-related behavior, the greater the momentum. And the greater the momentum, the greater the likelihood the process will be sustained and contribute to the ultimate benefit—a Total Safety Culture" (Geller 1999a, 16). With corporate executive vision, managerial support, and line-worker participation, these interventions target individual behavior on a large scale and lead to the enrichment of a culture. This organizational process could be applied on a national scale.

Focusing on the Total Safety perspective, this paper specifies the components of, and actions needed to create, what might be called a "Total Safety Traffic Culture." While considered Utopian thinking by some, we believe this to be a realistic proposal if traffic safety is elevated to the level of a true societal value.

The development of a Total Safety Traffic Culture would have positive implications for other societal safety issues as well, as the ultimate objective is to persuade citizens to exhibit a kindred sense of responsibility for the welfare of others, such that people monitor and change their own behavior and support others in doing the same. Indeed, the benefits of a Total Safety Traffic Culture should spill over into many areas of daily life, as everyone would know how to design behavioral-safety interventions for their own needs, and actively caring would be regularly demonstrated, cultivated, and promulgated. So, the crucial question is: how do we make traffic safety normative?

Issues in the achievement of a Total Safety Traffic Culture

Targeting culture change in any context requires an understanding of the present state of the culture in question. While a great deal of empirical work can and should be accomplished to pinpoint the exact nature of the traffic safety culture in the U.S. today, it can be safely described as top-down, which is to say it is primarily law enforcement based.

Traffic safety legislation is often promoted by caring individuals or legislators who have lost a loved one in a crash, organized groups such as Mothers Against Drunk Driving, or policy makers concerned with cost-benefit ratios and state liabilities. The main difficulty with all legislation is that it relies heavily on enforcement as a means of accomplishing goals, and law enforcement is usually a limited resource, able only to monitor a small sample of drivers at any given time. One of the chief advantages to legislation is that it sets standards for behavior.

Generally speaking, the standards for traffic safety behavior are proactively addressed in a systematic fashion only with our teenage youth and usually only in the context of driver education courses and/or in studying for license tests. Some parents contribute positively to this limited process, but many model unsafe behaviors. After getting a license, traffic safety issues rarely come to mind unless we are stopped for an offense, involved in a crash, or hear about a crash. Reference to car crashes by the public as "accidents" underscores the common perception that traffic safety is perceived to be largely beyond our personal control. Indeed, traffic safety as a collective issue is so immense that improvement efforts have traditionally been piecemeal and reactive, as opposed to holistic and proactive.

This state of affairs must change if we as a society are to make significant advancement in traffic safety. To do so, we need to teach traffic safety to children and adults, from preschool to the university level, at the workplace and in the home, and promote relevant discussions in all types of social contexts. This will only happen if our leaders (in all areas—e.g., school, religious, community, legislative) tirelessly verbalize traffic safety as being a value to be proactively and ubiquitously addressed. In other words, we need to create a Total Safety Traffic Culture.

An industrial Total Safety Culture is an environment where all members of the organization feel responsible for safety, pursue safety objectives daily, and go "beyond the call to duty" to identify and intervene to correct hazardous conditions and at-risk actions (Geller 1994). When this vision is accomplished, an organization's members routinely demonstrate actively caring for safety. This has been achieved and sustained in numerous large corporations (Geller 2001b). These organizations adopt safety as a key value, not a priority that shifts with situational demands. Large-scale and long-term actions with this focus can transform a culture from a state of dependence or independence with regard to safety to a dynamic state of *interdependence*.

Types of organizational safety cultures

With regard to traffic safety, the organization in question is society, which functions as a relative whole only at special times and actually shares only a few major values. Our society generally functions as a loosely linked set of suborganizations, subunits, communities, families, and individuals. In reference to our top-down traffic safety culture, U.S. society generally promotes a dependent paradigm. Table 1 summarizes important differences between three cultural safety orientations.

A dependent culture is top-down in nature, and is safety conscious to the degree that disincentives are created by top management to ensure minimally acceptable levels of safety. Thus, police cite drivers for breaking established laws. Blame is readily sought and penalties are enforced to the extent possible. Safety is fairly important but is neither a priority nor a value. In this context, traffic safety is more about avoiding penalties than achieving personal safety, as was seen with the initial and continuing efforts to promote safety-belt use. Some did adopt the buckle-up habit for personal reasons, but were that the case for most, there would have been no need for laws, car buzzers/lights, or major media campaigns.

Table 1: Characteristics of differing organizational cultures. Adapted from Geller (2002).

Dependent	Independent	Interdependent
Top-Down	Bottom-Up	Empowerment
Conditions of Licensure	Personal Commitment	Team/Community Commitment
Safety for Ticket Avoidance	Safety for Self	Safety for Self and Others
Disincentives for Outcomes	Incentives for Outcomes	Recognition for Behavior
Environment Focus	Behavior Focus	Environment/Behavior/Person
Fault Finding	Fact Finding	Systems Thinking
Safety is Important	Safety is a Priority	Safety is a Value
Quick Fix	Eventual Fix	Continuous Improvement

In the dependent culture, laws are enacted as relatively convenient, quick fixes to specific problems. The difficulty, of course, is enforcing the laws on the scale needed to bring about comprehensive change. And, as an initial step to culture change, these types of legislative efforts are indeed important contributions, establishing societal norms.

An independent culture relies more on individuals attending to safety through personal commitment and a desire to achieve protection. Safety issues are explored in a fact-finding manner, with an emphasis on identifying important contributory variables, where blaming a person or circumstance is not the primary mission. Safety becomes a priority, and prevention is more a collaborative process where incentives or social campaigns (e.g., commercials exhorting people not to drink and drive) are used with the hope of having a beneficial, proactive impact.

In an independent culture, grassroots organizations and concerned family members play a greater role in attempting to bring about traffic-safety reforms. Social marketing is central and ranges from engaging in impassioned personal conversations to organizing rallies and school programs, funding relevant public-service announcements, and lobbying for legislative reform.

While these are good things bringing about positive change, the paradigm we need to understand and achieve for a Total Safety Traffic Culture is that of *interdependence*. A number of the qualities of the other forms of culture are retained, including behavior-based incentives and disincentives. But, a major quality of an interdependent safety culture is actively caring for others, which is reinforced by the natural consequences of helping. Good citizenship becomes associated with safe driving. Safety becomes a value, and values always take precedence over goals, which are ever changing and dependent on the situation. With safety as a value, everyday traffic situations activate safe driving behaviors throughout an entire trip.

Environment and behavior are still critical foci for intervention, but interdependent cultures take person states into account. How people feel about an intervention is considered. Problem solving is systems oriented, seeking not only activators for specific behaviors, but also consequences likely to motivate and maintain safe behaviors, as well as person states that support safe versus at-risk behavior. This perspective ensures safety-related interventions are well received by the target audience, minimizing reactance (i.e., an assertion of independence by deliberately ignoring or doing the opposite of what is desired; Brehm 1966) and empowering people to be part of a problem-solving team at every level to make safety an ongoing process that facilitates continuous improvement.

The behavioral approach to safety

Ultimately, individual drivers are key to further improvements in collective traffic safety. Ostensibly, all driving-related laws, public-relations media, and safety education and training are intended to influence the behavior of individual drivers. While these are important efforts, more can be done. To influence behavior on a large scale, we can learn a great deal from the success of behavior-based safety (BBS) initiatives in industry. Research evidence shows this approach has been quite successful across a variety of industrial contexts (e.g., DePasquale and Geller 1999; Geller 1999b; Geller et al. 1998; Sulzer-Azaroff and Austin 2000).

Before delving into the particulars of BBS, a brief overview of a few applied behavior analysis principles is warranted. Eminent researchers, such as Thorndike, Watson, Hull, Wolpe, Skinner, and their countless colleagues, have scientifically studied behavioral phenomena and showed us that most, if not all, behavior is learned, maintained, or discontinued as a function of related consequences, be they anticipated, imagined, or actual.

The *ABC model* provides a framework for understanding why people do what they do and what it takes to change what they do. 'A' stands for *Activator*, 'B' for *Behavior*, and 'C' for *Consequence*. Applied behavior analysis involves identifying and understanding the role of each of these elements in order to orchestrate contingencies that promote beneficial change in prescribed directions. Activators signal the availability of consequences, thereby directing or suppressing behaviors relevant to acquiring pleasant or avoiding unpleasant consequences. Actions that enable desirable consequences tend to be repeated, while actions followed by undesirable consequences are less likely to occur again. People often encounter, but are not necessarily mindful of, multiple sets of concurrent activators, behaviors, and consequences.

As a basic illustration, a stop sign signals for stopping a vehicle, where doing so brings a consequence of crash avoidance and safe traffic flow. However, if a stop sign is viewed on a road with minimal traffic, this activator may result in slowing down, but not complete vehicle stopping. To shave a few seconds off a drive in this manner may not seem on the surface to be a powerfully rewarding consequence, but rapid acquisition and long-term maintenance of such behavior suggests otherwise. Suppose one day, a police car is present at the intersection and the driver who habitually runs the stop sign, makes a complete stop upon seeing the patrol car. This new activator influenced behavior change. The driver stopped completely in order to avoid the consequence of inconvenience and a financial penalty. Should the driver not see the patrol car, the consequence of running the stop sign would likely be the receipt of a citation. The next encounter with the stop sign would likely activate a complete stop, until the memory or threat of confrontation with the law wanes. Should the consequence of running the stop sign have been a crash, subsequent complete-stopping behavior would likely occur for a prolonged period.

It is important to note that road signs and other environmental conditions are not the only antecedents affecting traffic and driving behavior. There are many antecedent conditions that set the occasion for at-risk behavior, including such multitasking as: talking on phones or with passengers; watching nonrelevant signs, billboards, pedestrians, or other vehicles; selecting or attending to in-vehicle entertainment; reading; checking appearance; eating and/or drinking; etc.

With this primer in mind, let's take a closer look at BBS. In 2001, Geller proposed seven major principles of BBS and later updated them with his *People-Based Safety™* (PBS) approach (Geller 2005a). Basic principles of BBS are covered in brief, and aspects of PBS are noted.

1. Begin with observable behavior. Behavior-based interventions target behaviors that can be observed by others. The focus is on what people do and the application of an evidence-based strategy for improvement. The mission is to *act people into thinking differently* rather than to *think people into acting differently*, as is the case with many traffic safety interventions. Following the management maxim "what gets measured, gets done," this is accomplished through the use of observers who give feedback with a protocol that requires minimal training. If we want turn-signal use to increase, we might have a coworker make observations of the driver's signal use in a defined time period (e.g., a specific trip, a ten-minute interval).

PBS recognizes the notion that people, if properly motivated, can think themselves into safer actions. Behavioral self-management is certainly possible as we can note and act on our own thoughts, attitudes, and beliefs. Yet, both BBS and PBS interventions focus on improving specific behaviors with an observation and feedback process.

2. Look for external factors to understand and improve behavior. BBS deals primarily with activators and consequences. A variety of environmental determinants of behavior are defined (i.e., activators and consequences), which often suggest intervention strategies. Some factors encourage at-risk behaviors, such as the lack of opportune and socially valid substitutes, such as is somewhat the case with alternatives to driving while impaired (DWI). Other factors hinder the adoption of safe behaviors, such as the inconvenience, discomfort, and perceived unattractiveness of wearing motorcycle and bicycle helmets. By calling attention to, altering, eliminating, or adding external factors to the environment, at-risk behaviors can be decreased and/or safe behaviors increased.

The phase "swift and certain" applies here. If pleasant consequences are swift and certain and unpleasant consequences delayed and uncertain, the relevant behavior will likely persist. Drivers take risks because they expect to gain something, like time or convenience, or avoid something, such as discomfort or inconvenience.

When drivers don't use safety equipment or don't follow safe-operating procedures, they are usually rewarded by perceived increases in consequences like comfort (e.g., "unhindered" by a safety-belt or helmet), convenience (e.g., talking on a cell phone), and speed of travel (e.g., speeding or running through stop signals). Thus, the perceived rewards for risky driving appear swift and certain, whereas aversive consequences are distant and uncertain.

Most drivers, when sober, say DWI is not acceptable and that the odds of being caught are relatively high. But once drunk, one may drive anyway to avoid: a) taxi fare, b) adherence to the whims and/or schedule of a sober designated driver, c) leaving a vehicle overnight, and/or d) the loss of perceived freedom or personal control. Besides avoiding these perceived inconveniences, the possibility of a crash or arrest is actually relatively unlikely (see Dula, Dwyer, and LeVerne, in press). As one drinks, reasons to drive may outweigh the prohibition against doing so. Thus, the DWI offender sees gains as swift and certain and negative consequences as unlikely. This can be a tough set of circumstances to overcome, but problem solving must begin with a frank assessment of the maintenance factors for the at-risk behavior.

The PBS perspective addresses related thoughts, perceptions, and attitudes. However, as most of our current interventions already target such variables, we should focus on increasing our use of practical principles of behavioral science.

3. Direct with activators and motivate with consequences. Activators influence behavior only to the degree that related consequences are soon, certain, and sizable. Activators tell us what to do in order to receive or avoid consequences. The ABC model suggests use of activators that specify behaviors and consequences, and which are supported by the implementation of swift and significant consequences. A half century of behavioral science demonstrates the value of this approach in designing successful behavior-improvement interventions at individual, group, and organizational levels (Geller 2001a, 2001c, 2001d).

4. Focus on positive consequences to motivate behavior. In managing individual behavior on a large-scale, it may seem to many that punishment is the only viable approach. While it can be effective under certain conditions (cf., Azrin and Holz 1966), punitive consequences are rarely sufficient in size, swiftness, or certainty to influence the behavior of many who choose to drive at-risk. Using negative consequences to control behavior reduces perceptions of personal control, responsibility, and freedom, and may generate reactance and other undesirable side effects such as the experience of negative emotions (e.g., Newsome, Favell, and Rincover 1983; Sidman 1989). Punishment does not generally lead to the teaching and supporting of desired actions either, and people generally feel less empowered when working to avoid negative consequences than when working to achieve pleasant consequences (e.g., Geller 2002).

There is growing evidence showing positive reinforcement to be a productive means to increase safe driving (e.g., Austin, Sigurdsson, and Rubin 2006; Everett, Haywood, and Meyers 1974; Geller, Kalsher, Rudd, and Lehman 1989; Hagenzieker 1991; Hickman and Geller 2003; Kalsher, Geller, Clarke, and Lehman 1989; Ludwig, Biggs, Wagner, and Geller 2001; Olson and Austin 2001; Rudd and Geller 1985; Slater 1999), though Geller (2001a) noted a need for more long-term research.

Some may think it odd to "reward" behavior that "should" happen anyway. Some think "rewards" must be tangible or costly. Tangibles are not necessary, though tokens, prizes, and the like can be used to good effect. Simple conversation can be rewarding, and this power is seen anytime a respected other gives us a smile or pat on the back for doing a good job. Praise is quick, easy, and free. It is interesting to note how quick many are to notice and criticize "bad" behavior. Why are we not as quick to notice and praise "good" behavior? And if a behavior that "should" happen anyway isn't happening, why not try positive reinforcement?

See Flora (2004) for a review of studies rebuffing arguments that reinforcement should not be used to motivate desired behavior. If we focus on, and give genuine support to one another for safe driving, the reinforcement principle dictates the rewarded safe behaviors are more likely to occur again. Of course, whether or not they actually do recur is an empirical question, which leads us to the next BBS principle.

5. Apply the scientific method to assess and improve interventions. The only way to be sure an intervention has a desired effect is to measure the target behavior before, during, and after an intervention. Scientific methodology provides information necessary to determine if there are changes in a target behavior, and when there is no improvement, to point out the need to modify our techniques. The acronym "*DO IT*" teaches the scientific method to safety leaders and lay persons alike.

'D' is for *Defining* the target behavior to be increased if "safe" or to be decreased if "at-risk." 'O' is for *Observing* (and recording) the target behavior over a baseline period to identify social and environmental factors influencing the behavior, to set goals, and to obtain data for intervention evaluation. 'I' is for *Intervening* with a BBS plan and 'T' is for *Testing* intervention efficacy through continued observation and recording of the behaviors. This process can be facilitated with a *critical behavior checklist* (CBC).

Basic to BBS is a process whereby workers create CBCs, or checklists of safe and at-risk behaviors, which are then used to guide the observation and recording of target behaviors. The CBC lists target behaviors and has a column to note whether a performed behavior was "safe" or "at-risk." Definitions of "safe" versus "at-risk" are developed in group discussions designed to build

consensus. The CBC is then used to give feedback in face-to-face or group conversations (e.g., Depasquale 1999; Geller 2001c, 2001d, 2005c; Krause, Hidley, and Hodson 1996; McSween 2003; Williams and Geller 2000). Observation and feedback are tied directly to the CBC, so careful definition of safety-related behaviors and safe performance standards is vital.

This BBS process can't succeed without interpersonal trust—a dimension of PBS. BBS observation and feedback processes require openness, discretion, and sincerity between workers, supervisors and administrators, all of whom contribute to the development and maintenance of a Total Safety Culture (DePasquale and Geller 1999). The CBC provides a framework for a BBS intervention and can enhance trust by reducing the potential for personal bias by virtue of its objective nature and positive focus. This process should be essentially the same for teachers, families, or companies working to improve traffic safety behaviors.

Indeed, the CBC has potential for broad applications in driving safety. Geller (2003c) discussed use of a CBC in the contexts of increasing safety-belt use, reducing vehicle speed, using turn signals, checking tire inflation, and correcting child safety-seat installation. He also provided a driving CBC sample he used to teach safe driving to one of his daughters. More details about the construction and use of a CBC can be found elsewhere (e.g., Geller 1996, 2001c, 2003b, 2003c; Geller and Williams 2001), as can important issues regarding behavioral inconvenience, risk exposure, behavior severity, and behavior probability (Geller 2003b, 2003c).

After filling out a CBC, a "percent-safe" score can easily be calculated for any driving behavior. The reliable increase of a percent-safe score over time indicates intervention efficacy. The lack thereof suggests a need to revisit intervention design, activators, behavioral definitions, participation quality, and/or consequences. Similarly, success of intervention adjustments can be shown objectively in short order. Moreover, analyses of successive DO IT processes can produce a knowledge base that can be incorporated into a theory, as is emphasized in the next principle.

6. Use theory to integrate information. Patterns tend to emerge following systematic use of the "DO IT" process. Some techniques work better than others, depending on situations, behaviors, and people involved. Connecting intervention impact to social or contextual variables yields guiding principles for similar situations. For example, a successful approach to increasing turn-signal use might also work well for increasing following distance. The resulting theories suggest the most cost-effective intervention methods under a designated set of circumstances. Beyond this scientific methodology, one final PBS principle alluded to throughout this presentation merits contemplation.

7. Consider the feelings and attitudes of others. Though people's feelings and attitudes may be more difficult to ascertain and influence than their behaviors, attending to feelings and attitudes is critical. They impact, and are influenced by any intervention. Those who develop an intervention strategy should consider the cognitive and affective implications of their approach, taking into account the attitudes, opinions, and beliefs of the target audience. Genuine empathy for participants is a powerful means for leaders to understand and defuse reactance, as well as to motivate and reward participation. We suggest that positive consequences be used whenever possible because when people feel better about a process, they are more likely to fully participate and benefit from it (e.g., Geller 2002). With that said, we turn to other important factors, such as trust, organizational support, mandatory participation, and recruiting lay safety leaders.

Depasquale and Geller (1999) emphasized that the success of BBS rests on maximizing participation, interpersonal trust, and organizational support. Suppose, for example, a high school and its PTA generate a BBS driving program and implement a CBC-based observation and feedback process during their driver-education courses. To increase chances for success, the principal, teachers, parents, and students should all be involved in designing the CBC and the implementation process. Moreover, school boards, school systems, local law enforcement, and local media outlets should overtly demonstrate support. Businesses might be enlisted to provide incentives for those who participate, to put up flyers endorsing the program, or to offset the relatively small costs associated with photocopying CBCs, all of which would make for good public relations with potential or actual customers. Everyone should be aware of the mission (safer drivers and safer roads), the details of the observation and feedback process, research supporting its use, and the need for full participation. The more people and organizations there are involved at the outset, the more enticing it will be to join in.

Depasquale and Geller (1999) found that mandatory participation in the observation and feedback method was not particularly aversive to participants as long as there was freedom in when, where, how, and with whom one engages in the process. Thus, in this example, a CBC procedure might be required of all student drivers (e.g., asking parents to complete CBCs on their child's driving, and turn them in for part of the course grade). Alternatively, students in driver education programs could serve as BBS agents for one another under the supervision of the instructor. For willing parents and siblings, the CBC process can be reversed and the student can rate the more seasoned driver's behavior, making everyone more conscious of traffic safety in the process. In an alternate scenario elementary school children could fill out CBCs on their parents (which would encourage parents to be more model drivers) and local businesses or other organizations might contribute prizes to be raffled off for turning in CBCs filled out by children and their families.

The data generated by collected CBCs could be used to create posters or public service announcements to openly display charted driving improvements. The trust issue can be handled easily in this type of scenario as observations and feedback can be done by family members, and individual results can be kept confidential, while only posting group results. Whatever the case, it is important for BBS interventions to have maximal organizational support, conditions that build interpersonal trust, and high levels of participation.

With a Total Safety Traffic Culture, much like in an industrial Total Safety Culture, when people consistently perform the desired behaviors, they can be enlisted as agents to influence the safety of others (Geller 1998a; Geller et al. 1990). Safety professionals often find themselves "preaching to the choir," but focus should be on empowering the choir to win over others to the cause. The more people who are on board for safety, the more safety becomes a demonstrated value, and the more often holdouts will convert to safe practices.

Roberts and Geller (1994) found a positive correlation between the number intervention agents involved in safety-belt promotions and the impact of the intervention. Becoming an agent for safety change moves one toward developing self-accountability and self-directed behavior for injury prevention (Geller 1998a). The idea that people who learn BBS can take on the role of a safety change-agent, promoting continual concern for the safety of others, leads us to a discussion of the *Actively Caring* model, which incorporates a holistic PBS perspective.

Actively Caring for safety

The Actively Caring model can help us understand what it takes to achieve the vision of a Total Safety Traffic Culture. Use of this model has helped numerous industrial sites shift to a Total Safety Culture. While the concept of a Total Safety Culture has not been pursued beyond the work environment, we strongly suggest it should be attempted at a societal level for traffic safety. Actively caring behavior in a work context is operationalized as persistence in looking for environmental hazards and risky work practice and intervening to bring about corrective actions or conditions. Thus, actively caring is behavior activated by an intrapersonal state in which one's attitudes and beliefs increase a willingness to contribute to the health and well-being of others.

Actively caring person mindsets have been researched as a predisposition to act (Allen and Ferrand 1999; Geller, Roberts, and Gilmore 1996; Roberts and Geller 1995; Porter 1998), but actively caring is also conceptualized as a teachable construct. Geller (1991) examined social and personality psychology for relevant person states to predict who would most likely engage in actively caring behaviors. The presumed components of an actively caring stance are: a) high self-esteem (feeling valued), b) high self-efficacy (believing you can make a difference), c) an internal locus of control, d) an optimistic outlook, and e) a sense that one belongs to a cohesive group (e.g., family, friends, coworkers, community). Figure 1 displays the person states, each contributing to feelings of empowerment with overlaps that reflect critical belief statements. The model was tested using surveys to measure the five actively caring states, and findings generally supported the theoretical mechanisms proposed (Allen and Ferrand 1999).

Most people do not want bad things to happen to their family, friends, coworkers, or even strangers, but our culture does not pull for a demonstration of actively caring on a regular basis. Before intervening in an emergency, people are faced with barriers to helping, as exemplified by the following questions: Is something really wrong? Is help needed? Should I intervene? Do I know what to do? Only if each is answered in the affirmative, are people apt to actively care and intercede (Latané and Darley 1970). However, actively caring strategies can be taught to offset helping hurdles. In fact, the Red Cross teaches some such skills to those learning CPR and First Aid, including: a) be on the lookout for emergency situations, b) assume responsibility as a trained helper, c) actually check to see if help is needed, d) direct others to specific tasks (e.g., "You, call 911!"), and, e) attempt to provide help. Thus, it stands to reason that actively caring concepts can be taught to our youth throughout their education, so they will arrive at adulthood with an actively caring perspective and relevant skill sets, and that adults can pick up and make use of the concepts as well.

A company's culture can inhibit predispositions to actively care by encouraging at-risk production methods and safety shortcuts. On the other hand, a company that aspires to become a Total Safety Culture must redefine itself to hold safety as a value, seeking employee input into the safety improvement process. This enhances predispositions to actively care, but also activates actively caring among those less inclined to do so, by increasing optimism (e.g., "they consider my input") and belongingness (e.g., "our work team actively cares for one another"). And these

factors combined may actually raise self-esteem. Likewise, an interdependent actively caring culture of citizens armed with BBS knowledge and the will to use it will progress toward a Total Safety Traffic Culture.

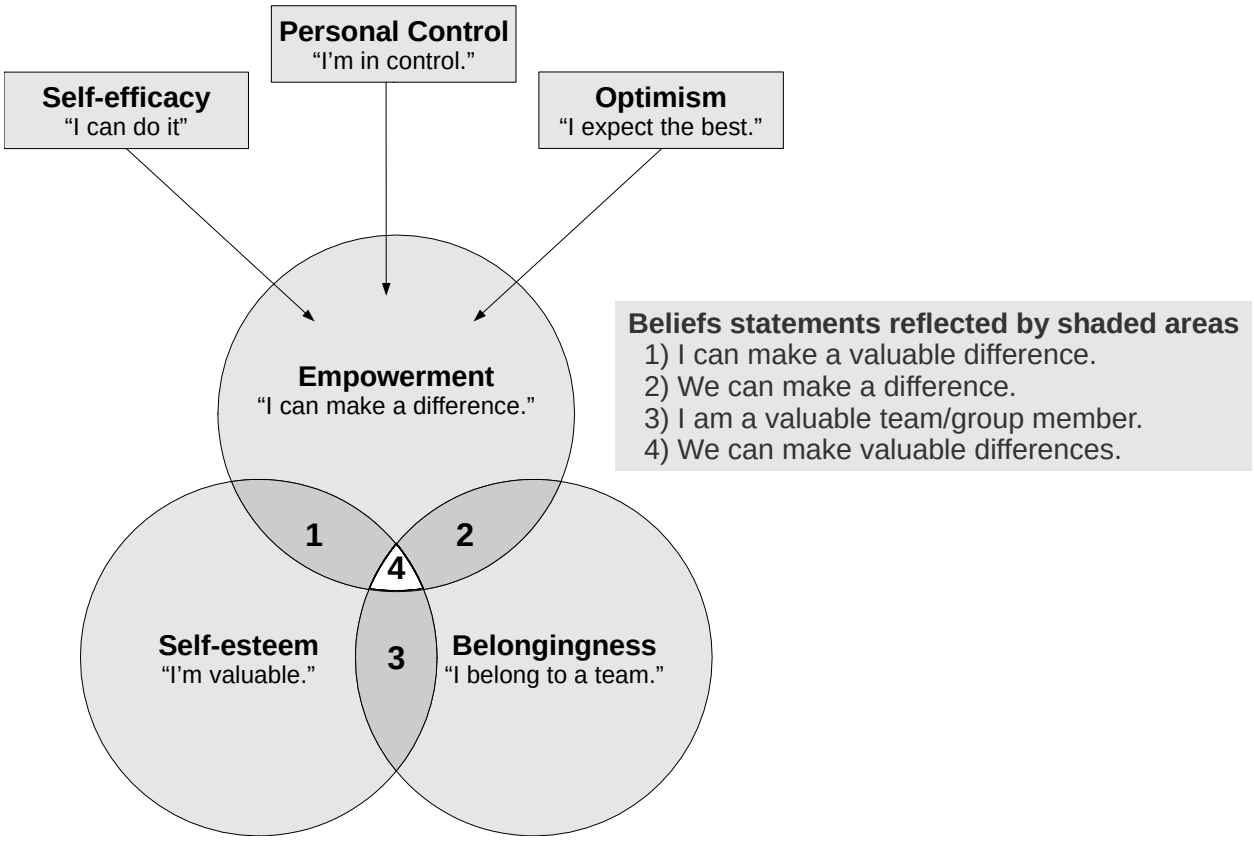

Figure 1: Actively Caring Model. Adapted from Geller (2002).

Venues and approaches to improving traffic safety behavior

Two of the greatest advantages to the BBS and actively caring approaches are the facts that they are easy to teach and inexpensive to implement. However, culture change takes time and the efforts to achieve such a change must be large-scale and pervasive. One of the main venues we have for disseminating cultural and technical information is our educational system. A focused nationwide campaign to teach behavioral science and actively caring skills throughout elementary, middle, and high school would do much to achieve and sustain a Total Safety Traffic Culture, where BBS strategies would target vehicle safety, from private to public transportation.

Teaching traffic safety through BBS and the Actively Caring model in school systems is quite feasible, and would likely impact other safety domains. It would also behoove us to have a traffic

safety course at every college and university using BBS principles. We could insert traffic safety issues into general education courses such as history (e.g., noteworthy figures lost to traffic crashes, the rise of vehicles, roadways, injuries, and death tolls), psychology, sociology, health, physics and engineering (e.g., the progression of vehicle and roadway safety engineering), mathematics (e.g., traffic safety statistics could be used for examples), and students could even be encouraged to write on related topics in English classes. Courses that speak to personal identity, interpersonal ethics, and social responsibility are common in university settings and are certainly appropriate venues for traffic safety issues. A similar list of courses could apply to primary and secondary educational settings as well.

To provide a context for BBS and actively caring, it is useful to consider that most people probably care about safety, but in some cases may lack knowledge regarding what is safe or how to obtain support for choosing safe over at-risk behaviors. Where people knowingly take risks, it is likely that probabilities for disaster seem so remote as to be insignificant. A lifetime of traffic safety learning would probably help to show how remote risks are real, dispel the myth that driving safety is the "other person's" problem, instill a more profound sense of responsibility for driving a vehicle, and promote attitudes that inhibit thrill seeking or careless driving.

Thus, in teaching traffic safety methods and responsibilities, perspective should also be expanded from the single driver's perspective to a collective societal viewpoint, to emphasize the role of the individual in society. Systems-thinking is needed here. Drivers need to see beyond the seemingly isolated environment of their own vehicles and consider the complex, interdependent system of a synchronized traffic structure. From early childhood, we must teach our citizens to appreciate who is affected by traffic crashes, including children, teens, and young/middle/older adults, in the form of lost lives, painful and debilitating injuries, lost freedom for offenders, property damage, snarled justice systems, lost personal and business productivity, higher insurance rates, higher taxes, higher healthcare costs, and on and on.

School is an obvious choice and an important venue for conveying the principles, policies, and procedures of a Total Safety Traffic Culture. However, this is by no means the only venue. We only need to realize that virtually every citizen has been touched in some way by a traffic crash, to understand that many, if only prompted or prodded, would see their way to learning about and teaching BBS to facilitate and support the taking of greater personal responsibility for vehicle safety. There are a multitude of outlets at local, regional, and national levels for this kind of interpersonal support, teaching, and learning of traffic safety, including: a) athletic events from peewee to professional levels, b) every government agency, c) faith-based organizations and communities, d) the healthcare industry, e) businesses of all sizes and types, f) every type of media and entertainment, g) libraries, h) museums, i) community and neighborhood associations, j) fraternities and sororities, k) civic organizations, l) hobby and interest groups, and so on. The specific traffic safety topics to be addressed are plentiful and can be customized to the audience.

To illustrate the whole array of traffic safety domains, a categorical traffic safety issue grid is useful to identify change-advocacy areas. Figure 2 shows how the wide variety of general traffic safety can be arranged to promote a greater appreciation of their complexity and used to help identify interventions and teaching opportunities. A brief glance at Figure 2 shows dangerous

driving issues grouped into five broad categories, which could be addressed within three widely definable geographical areas, with four major age categories of target participants. This overview has a total of 60 potential intervention cells. On one hand, this model explicates the vastness of the subject at hand; while on the other hand, it helps intervention designers focus on particular issues, locations, or target groups, without losing sight of the big picture.

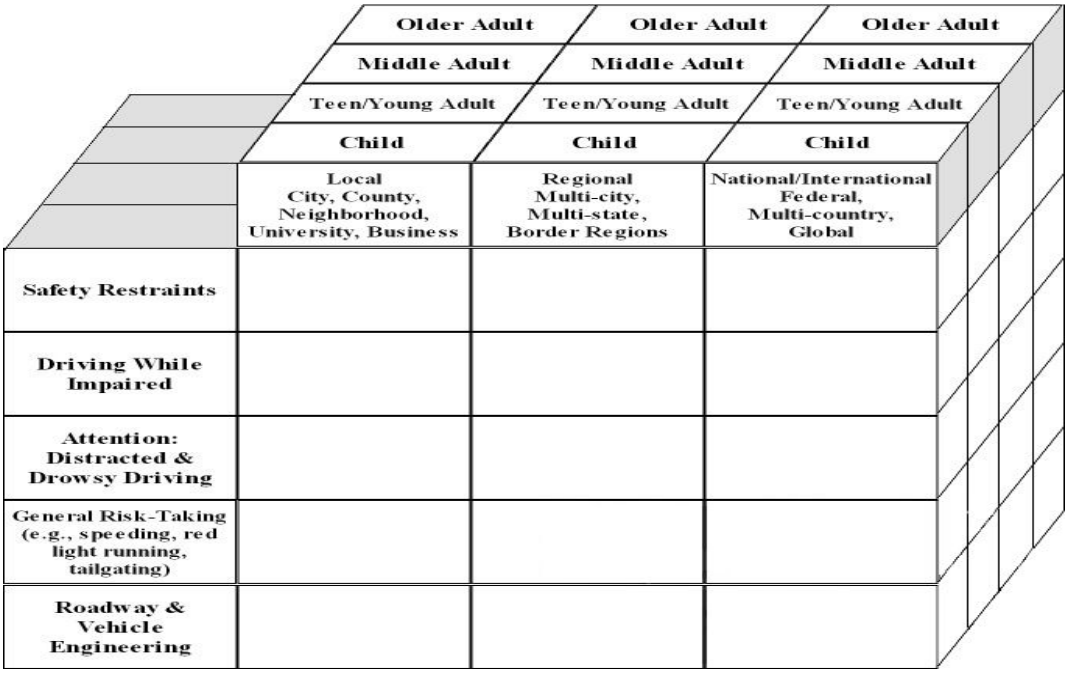

Figure 2: Traffic safety issues, target audiences, and target geography.
(Thanks to Dr. Bruce Behringer for sharing this conceptual representation method.)

The framework depicted in Figure 2 can be modified along any dimension to expand or contract coverage, as needed. For example, if driving attention issues were the target for potential interventions, different subtypes could occupy the left-hand column and include drowsiness, cellular-phone use, in-vehicle entertainment devices, passenger distractions, and driver emotions. Geographical area could be narrowed across the top row to include specific places in a town or county. Age categories could be broken down to signify different intervention needs, as in the case of child-safety restraints (e.g., infant, toddler, preschooler, school age). Target group categories might be changed to variables such as race, sex, socioeconomic status, rural versus urban residential status, level of experience, etc. Another dimension might be created for common interventions for particular issues. Given many outlets and approaches to traffic safety education and intervention design and delivery, we now turn to inducing the "choir," those who already practice or who come to practice safe driving, to become "preachers."

Recruiting and training traffic safety behavior change agents

The process of identifying and training leaders at all levels of society for the Total Safety Traffic Culture movement is at once easy and difficult. It is easy in that most citizens drive or ride at some point in their lives and have been, or are at-risk for being, directly or indirectly affected by traffic crashes. Thus, almost everyone is a potential traffic safety agent.

As noted earlier, training in BBS processes is relatively easy, with only a little instruction enabling people to perform observation and feedback with skill. If this approach were applied across the educational spectrum, children would be repeatedly exposed to this simple and straightforward process and should be "experts" within a few years. Peer teaching of the BBS and actively caring concepts is not only possible but desirable, as the transmission of knowledge by familiar others will increase acceptance and use of the ideas at hand to "learners" and reinforce the "teacher's" self image as a proactive and safety conscious citizen.

On the other hand, involving great numbers of citizens in pursuing a Total Safety Traffic Culture is a formidable challenge. It will take famous leaders, such as our presidents, governors, congressional and state representatives, activists, professional athletes, stars of television, movies and music, and other nationally known personalities, to speak out with a consistent and meaningful message. A national move to incorporate of traffic safety education into elementary and secondary school curricula would be most helpful. If we blend traffic safety with other educational topics which are universally taught, many opportunities to educate in the service of preventing traffic tragedies will be gained. Traffic safety activators should be everywhere, in all of the venues listed above, and not just on the occasional television spot or billboard. As more people are prompted to consider traffic safety issues, more will be inclined to examine how they can contribute to solving our ongoing national traffic tragedy. As a dramatic perspective tends to motivate people to action, one could use the consistent terminology of the "ongoing traffic tragedy," or in the sense that safety and security are somewhat synonymous, the problem could be couched in terms of a national security issue, albeit of an unusual type. The point is again, that traffic safety must be elevated to a value at the societal level for progressive cultural change to come about.

Guidance in positive approaches to traffic safety behavior change

Many types of creative traffic safety advocacy efforts have been implemented previously, and exemplify the BBS and actively caring principles. The successes and failures of these efforts can be used to inform future efforts. While space does not permit listing all the community-based interventions to increase traffic safety, a literature search in almost any specific traffic safety area reveals a host of both traditional and unorthodox approaches. Creativity is called for when trying to change a culture.

We emphasize use of positive consequences to promote safe behaviors, as this approach is likely to be well received, promote good feelings, and contribute to the interdependent paradigm needed for a Total Safety Traffic Culture. Still, punitive methods have their place. But when used, we should be careful to implement only those with sound evidence of efficacy and to increase their scope to levels which maximize effectiveness while incorporating additional tactics, such as persistent public display of outcomes, to further increase their impact by contributing to general deterrence (e.g., Dula, Dwyer, and LeVerne, in press).

The use of positive consequences to promote the use of safety belts (e.g., Boyce and Geller 1999; Campbell, Hunter, and Stutts 1984; Geller 1989; Geller, Davis, and Spicer 1983; Geller, Kalsher, Rudd, and Lehman 1989; Geller, Rudd, Kalsher, Streff, and Lehman 1987; Grant 1990; Kello, Geller, Rice, and Bryant 1988; Pastò and Baker 2001; Roberts and Geller 1994) and child safety seats (e.g., England, Olson, and Geller 2000; Greenberg-Seth, Hemenway, Gallagher, Ross, and Lissy 2004; Roberts and Layfield 1987; Roberts, Fanurik, and Wilson 1988; Task Force on Community Preventive Services 2001; Will and Geller 2004; Zaza et al. 2001) is well documented and these studies are helpful in showing how BBS and actively caring principles can be applied on a large scale. Similarly, field researchers have demonstrated practical ways to prompt safety-belt use and activate culture change with buckle-up promise cards (Geller and Lehman 1991), buckle-up flash cards (Geller, Bruff, and Nimmer 1985), and safety-belt reminders on airliners (Geller, Hickman, and Pettinger 2004). More comprehensive guides on the application of behavioral science to traffic safety issues are available and would be of great help to culture-change agents for traffic safety (e.g., Geller 1998b; Sleet and Lonero 2002).

Summary and recommendations

Initially, a desired norm may need legal and punitive push to gain a critical mass for change. However, moving beyond safety plateaus and achieving world-class traffic safety requires thinking outside the traditional engineering and regulation boxes. Only with appropriate focus on the human dynamics of safety, including environmental, personal, and social variables, can we significantly improve relevant human behavior beyond current levels. Systems and cultural factors must figure heavily into the design of cost-effective interventions. Making progress beyond status quo requires changing the status quo with regard to goal setting and intervention evaluation. What was acceptable before cannot continue to be standard if our future efforts are to make a marked difference. For a Total Safety Traffic Culture to be created and maintained, it is critical that our citizens understand, teach, and consistently apply behavioral science principles.

This paper described the tried and true methods of the behavior-based safety (BBS) process, which can be applied by anyone young or old, in an effort to improve traffic safety. Anyone doing so would demonstrate actively caring and likely inspire others to do the same, thus pushing us successively toward greater societal interdependency. Greater detail on the use of BBS, critical behavior checklists, actively caring, social dynamics of safety, safety communication skills, behavioral self-management, safety leadership, and other related issues can be found in a variety of sources (e.g., Geller 2000, 2001a, 2001b, 2001c, 2001d, 2002, 2003a; Geller and Williams 2001).

Some key barriers identified were: a) the general lack of a supportive cultural orientation for any large-scale shift toward greater traffic safety, b) the sheer number of relevant traffic safety inter-

vention targets, c) the need to teach BBS and actively caring principles to large numbers of people of all ages at all levels of society, d) the hesitancy of people to act on behalf of others without being trained to overcome helping hurdles, and e) the potential for reactance to top-down traffic safety interventions.

The facilitators identified were: a) the potential for society to rally around powerfully emotional causes, b) that traffic safety could be easily framed in terms of a national tragedy or a national security issue, to motivate citizens to create change, c) the BBS and actively caring concepts are easy to learn and to use, d) the BBS-related materials (e.g., CBCs, posters) are inexpensive to produce and costs may be offset by community businesses or organizations who can benefit from the positive exposure, e) the BBS processes may be easily repeated as needed, f) those who learn the concepts can become behavior-change agents and facilitate diffusion of the concepts to others, and g) participation as a change-agent for traffic safety will cultivate self-directed responsibility for safety. We conclude these facilitators should overcome the barriers, enabling a national movement to advance the cause of BBS and actively caring in the service of traffic safety. And, such a large-scale and comprehensive BBS safety process would undoubtedly generalize to other domains of public health and safety.

We have a specific recommendation as well. Service programs should be established in elementary, middle, and high schools to teach BBS and actively caring and to carry out CBC-based traffic safety improvement programs for car-riding students, and scholarly research should be conducted on these programs to produce detailed efficacy data. This would involve the monitoring of percent-safe scores and the use of surveys and focus groups to gauge participants' levels of concept comprehension, program adherence, traffic safety attitudes and beliefs, and perceptions of the interventions. Importantly, the process would also produce independently observable behavioral data as outcome variables, including safety-belt use, child safety-seat installation proficiency, turn-signal use, average speeds in school zones, and the like, during baseline, intervention, and follow up periods. The objective demonstration of increases in safe behavior and decreases in at-risk behavior should be the gold standard for any proposed approach to improving our culture as it pertains to traffic safety. Objective efficacy data will be needed to push for supportive programming on a national level.

Taking on large-scale projects in urban, suburban, and rural school settings has the advantages of: a) built-in infrastructure for interventions (e.g., system-wide methods for approval and endorsement of research, b) convenient access to participants, c) ease of data collection of all types at centralized school locations, d) the potential for quick community buy-in and support, and e) the ability to assess a variety of traffic safety issues across a variety of demographic samples (race, geography, ages/grades). Again, such an effort will provide the initial empirical evidence needed to convince others of the utility and cost-effectiveness of the approach, while providing additional guidance to others wanting to replicate and extend the process.

As this is a long-term proposition, the sooner we get started, the sooner we will reap the benefits and move toward the realization that safety can become the number one concern for all drivers at all times. A national tragedy can be turned into a national triumph. Momentum is important, and

the initiation of this compendium is evidence that the forces are in place to get us started moving in the right direction. Perhaps a Total Safety Society should be the ultimate vision.

References

Allen, J. B., and J. L Ferrand. 1999. Environmental locus of control, sympathy, and proenvironmental behavior: A test of Geller's actively caring hypothesis. *Environment and Behavior* 31:338–53.

Austin, J., S. O. Sigurdsson, and Y. S. Rubin. 2006. An examination of the effects of delayed versus immediate prompts on safety belt use. *Environment and Behavior* 38:140–9.

Azrin, N. H., and W. C. Holz. 1966. Punishment. In W. K. Honig, ed. *Operant behavior: Areas of research and application*. New York: Appleton-Century-Crofts.

Belasco, A. 2006. *Congressional research service report for congress: The cost of Iraq, Afghanistan, and other global war on terror operations since 9/11*. The Library of Congress: Washington, D.C. Retrieved Aug 3, 2006 from the World Wide Web: http://www.fas.org/sgp/crs/natsec/RL33110.pdf.

Boyce, T. E., and E. S. Geller. 1999. Attempts to increase vehicle safety-belt use among industry workers: What can we learn from our failures? *Journal of Organizational Behavior Management* 19:27–44.

Brehm, J. W. 1966. *A theory of psychological reactance*. New York: Academic Press.

Campbell, R. J., W. W. Hunter, and J. C. Stutts. 1984. The use of economic incentives and education to modify safety-belt use behavior of high school students. *Health Education* 15:30–3.

Department of Defense. 2006a. *Casualty reports*. Retrieved August 3, 2006 from the World Wide Web: http://www.defenselink.mil/news/casualty.pdf.

———. 2006b. Operations enduring freedom and Iraqi freedom casualty summary by state—as of July 8, 2006. *DoD personnel & procurement statistics: Personnel & procurement reports and data files*. Retrieved July 17, 2006 from the World Wide Web: http://siadapp.dior.whs.mil/personnel/CASUALTY/STATE_OEF_OIF.pdf.

Depasquale, J. P. 1999. *Exploring personal responsibility for participation in organizational processes: Antecedents and consequences*. Unpublished dissertation. Retrieved August 6, 2006: http://scholar.lib.vt.edu/theses/available/etd-03282000-15590036/unrestricted/depasquale.PDF.

DePasquale, J. P., and E. S. Geller. 1999. Critical success factors for behavior-based safety: A study of 20 industry-wide applications. *Journal of Safety Research* 30:237–49.

Dula, C.S., W. O. Dwyer, and G. LeVerne. in press. Policing the drunk driver: A large-scale assessment of law enforcement's impact on impaired driving. *Journal of Safety Research.*

England, K. J., T. M. Olson, and E. S. Geller. 2000. Behavioral observations find unsafe use of child safety seats. *Behavior Analysis Digest* 12:11–12.

Everett, P. B., S. C. Haywood, and A. W. Meyers. 1974. Effects of a token reinforcement procedure on bus ridership. *Journal of Applied Behavior Analysis* 7:1–9.

Flora, S. R. 2004. *The power of reinforcement*. Albany, NY: State University of New York Press.

Geller, E. S. 1989. The Airline Lifesaver: In pursuit of small wins. *Journal of Applied Behavior Analysis* 22:333–5.

———. 1991. If only more would actively care. *Journal of Applied Behavior Analysis* 24:763–4.

———. 1994. Ten principles for achieving a Total Safety Culture. *Professional Safety* 39 (9): 18–24.

———. 1995. Safety coaching: Key to achieving a Total Safety Culture. *Professional Safety* 40 (7): 16–22.

———. 1996. *The psychology of safety: How to improve behaviors and attitudes on the job*. Radnor, PA: Chilton Book Company.

———. 1998a. *Beyond safety accountability: How to increase personal responsibility.* Neenah, WI: J. J. Keller & Associates, Inc.

———. 1998b. *Applications of behavior analysis to prevent injuries from vehicle crashes* (2nd Edition). Cambridge, MA: Cambridge Center for Behavioral Studies.

———. 1999a. Building momentum for safety. *Industrial Safety & Hygiene News* 33 (3): 16, 18.

———. 1999b. Behavior-based safety: Confusion, controversy, and clarification. *Occupational Health & Safety*, 68:40–50.

———. 2000. Ten leadership qualities for a Total Safety Culture: Safety management is not enough. *Professional Safety* 45 (5): 38–41.

———. 2001a. Behavior-based safety in industry: Realizing the large-scale potential of psychology to promote human welfare. *Applied & Preventive Psychology* 10:87–105.

———. 2001b. A Total Safety Culture: From a corporate achievement to a global vision. *Behavior and Social Issues* 11 (1): 18–20.

———. 2001c. *The psychology of safety handbook*. Boca Raton, FL: CRC Press.

———. 2001d. *Working safe: How to help people actively care for health and safety* (2nd Edition). New York: Lewis Publishers.

———. 2002. *The participation factor: How to increase involvement in occupational safety.* Des Plaines, IL: American Society of Safety Engineers.

———. 2003a. *The psychology of a Total Safety Culture: From managing behaviors to leading people*. Chicago, IL: The National Safety Council.

———. 2003b. Use "ESP" to estimate risk. *Industrial Safety & Hygiene News* 37 (4): 16, 18. Retrieved July 17, 2006 from the World Wide Web: http://www.ishn.com/CDA/Archives/2242f405400c7010VgnVCM100000f932a8c0____.

———. 2003c. Pardon the inconvenience: Assess the degree of difficulty in doing a job safely. *Industrial Safety & Hygiene News* 37 (5): 14, 16. Retrieved July 17, 2006 from the World Wide Web: http://www.ishn.com/CDA/Archives/debedcd0b00c7010VgnVCM100000f932a8c0____.

———. 2005a. Seven basics of People-Based Safety™: Embracing empowerment, ownership, & trust. *Industrial Safety and Hygiene News* 39:14, 16.

———. 2005b. People-Based Safety™ in action: Five distinctions from behavior-based safety. *Industrial Safety and Hygiene News* 39:12, 14.

———. 2005c. *People-based Safety: The source*. Virginia Beach, VA: Coastal Training and Technologies Corporation.

Geller, E. S., T. D. Berry, T. D. Ludwig, R. E. Evans, M. R. Gilmore, and S.W. Clarke. 1990. A conceptual framework for developing and evaluating behavior change interventions for injury control. *Health Education Research: Theory and Practice* 5:125–37.

Geller, E. S., T. E. Boyce, J. Williams, C. Pettinger, J. DePasquale, and S. Clarke. 1998. Researching behavior-based safety: A multimethod assessment and evaluation. In *Proceedings of the 37th Annual Professional Development Conference and Exposition*. Des Plaines, IL: American Society of Safety Engineers, pp. 537–59.

Geller, E. S., C. D. Bruff, and J. G. Nimmer. 1985. The "Flash for Life": A community prompting strategy for safety-belt promotion. *Journal of Applied Behavior Analysis* 18:145–59.

Geller, E. S., L. Davis, and K. Spicer. 1983. Industry-based incentives for promoting seat-belt use: Differential impact on white-collar versus blue-collar employees. J*ournal of Organizational Behavior Management* 5:17–29.

Geller, E. S., J. S. Hickman, and C. B. Pettinger. 2004. The Airline Lifesaver: A 17-year analysis of a technique to prompt the delivery of a safety message. *Journal of Safety Research* 35:357–66.

Geller, E. S., M. J. Kalsher, J. R. Rudd, and G. Lehman. 1989. Promoting safety belt use on a university campus: An integration of commitment and incentive strategies. *Journal of Applied Social Psychology* 19:3–19.

Geller, E. S., and G. R. Lehman. 1991. The buckle-up promise card: A versatile intervention for large-scale behavior change. *Journal of Applied Behavior Analysis* 24:91–94.

Geller, E. S., and D. S. Roberts. 1993. *Achieving a Total Safety Culture through employee involvement*. Newport, VA: Make-A-Difference, Inc.

Geller, E. S., D. S. Roberts, and M. R. Gilmore. 1996. Predicting propensity to actively care for occupational safety. *Journal of Safety Research* 27:1–8.

Geller, E. S., J. R. Rudd, M. J. Kalsher, F. M. Streff, and G. R. Lehman. 1987. Employer-based programs to motivate safety-belt use: A review of short and long-term effects. *Journal of Safety Research* 18:1–17.

Geller, E. S., and J. Williams, eds. 2001. *Keys to behavior-based safety from Safety Performance Solutions*. Rockville, MD: Government Institutes.

Grant, B. A. 1990. Effectiveness of feedback and education in an employment-based seat belt program. *Health Education Research* 5:2–10.

Greenberg-Seth, J., D. Hemenway, S. S. Gallagher, J. B. Ross, and K. S. Lissy. 2004. Evaluation of a community-based intervention to promote rear seating for children. *American Journal of Public Health* 94:1009–13.

Hagenzieker, M. P. 1991. Enforcement or incentive? Promoting safety belt use among military personnel in the Netherlands. *Journal of Applied Behavior Analysis* 24:23–30.

Hickman, J. S., and E. S. Geller. 2003. Self-management to increase safe driving among short-haul truck drivers. *Journal of Organizational Behavior Management* 23:1–20.

Kalsher, M. J., E. S. Geller, S. W. Clarke, and G. R. Lehman. 1989. Safety-belt promotion on a naval base: A comparison of incentives vs. disincentives. *Journal of Safety Research* 20:103–13.

Kello, J. E., E. S. Geller, J. C. Rice, and S. L. Bryant. 1988. Motivating auto safety-belt wearing in industrial settings: From awareness to behavior change. *Journal of Organizational Behavior Management* 9:7–21.

Krause, T. R., J. H. Hidley, and S. J. Hodson. 1996. *The behavior-based safety process* (2nd Edition). New York: Van Nostrand Reinhold.

Latané, B., and J. M. Darley. 1970. *The unresponsible bystander: Why doesn't he help?* New York: Appleton-Century-Crofts.

Ludwig, T. D., J. Biggs, S. Wagner, and E. S. Geller. 2001. Using public feedback and competitive rewards to increase the safe driving of pizza deliverers. *Journal of Organizational Behavior Management* 21:75–104.

McSween, T. E. 2003. *The values-based safety process: Improving your safety culture with behavior-based safety* (2nd Edition). Hoboken, NJ: John Wiley & Sons, Inc.

National Highway Traffic Safety Administration (NHTSA). 2006. Transportation Secretary Mineta calls highway fatalities national tragedy, says all Americans can do more to improve road safety. Retrieved July 28, 2006 from the World Wide Web: http://www.nhtsa.dot.gov/portal/site/nhtsa/template.MAXIMIZE/menuitem.f2217bee37f-b302f6d7c121046108a0c/?javax.portlet.tpst=1e51531b2220b0f8ea14201046108a0c_ws_MX&javax.portlet.prp_1e51531b2220b0f8ea14201046108a0c_viewID=detail_view&javax.portlet.begCacheT.

Newsome, C., J. E. Favell, and A. Rincover. 1983. The side effects of punishment. In S. Axelrod and J. Apsches, eds. *The effects of punishment on human behavior,* New York: Academic Press.

Olson, R., and J. Austin. 2001. Behavior-based safety and working alone: The effects of a self-monitoring package on the safe performance of bus operators. *Journal of Organizational Behavior Management* 21:5–43.

Pastò, L., and A. G. Baker. 2001. Evaluation of a brief intervention for increasing seat belt use on a college campus. *Behavior Modification* 25:471–86.

Porter, B. E. 1998. Predicting active and effective agents for safety: Test of the *actively caring* approach. *Journal of Safety Research* 29:223–33.

Roberts, D. S., and E. S. Geller. 1994. A statewide intervention to increase safety belt use: Adding to the impact of a belt use law. *American Journal of Health Promotion* 8:172–4.

———. 1995. An actively caring model for occupational safety: A field test. *Applied and Preventative Psychology* 4:53–59.

Roberts, M. C., D. Fanurik, and D. Wilson. 1988. A community program to reward children's use of seat belts. *American Journal of Community Psychology* 16:395–407.

Roberts, M. C., and D. A. Layfield. 1987. Promoting child passenger safety: A comparison of two positive methods. *Journal of Pediatric Psychology* 12:257–71.

Rudd, J. R., and E. S. Geller. 1985. A university-based incentive program to increase safety-belt use: Toward cost-effective institutionalization. *Journal of Applied Behavior Analysis* 10:215–26.

Sidman, M. 1989. *Coercion and its fallout*. Boston, MA: Authors Cooperative, Inc., Publishers.

Slater, M. D. 1999. Drinking and driving PSAs: A content analysis of behavioral influence strategies. *Journal of Alcohol and Drug Education* 44:68–81.

Sleet, D. A., and L. Lonero. 2002. Behavioral strategies for reducing traffic crashes. In L. Breslow, ed., *Encyclopedia of public health*. New York: Macmillan Reference USA.

Sulzer-Azaroff, B., and J. Austin. 2000. Does BBS work? Behavior-based safety and injury reduction: A survey of the evidence. *Professional Safety* 19–24.

Task Force on Community Preventive Services. 2001. Recommendations to reduce injuries to motor vehicle occupants: Increasing child safety seat use, increasing safety belt use, and reducing alcohol-impaired driving. *American Journal of Preventive Medicine* 21:16–22.

Will, K. E., and E. S. Geller. 2004. Increasing the safety of children's vehicle travel: From effective risk communication to behavior change. *Journal of Safety Research* 35:263–74.

Williams, J. H., and E. S. Geller. 2000. Behavior-based intervention for occupational safety: Critical impact of social comparison feedback. *Journal of Safety Research* 31:135–42.

Zaza, S., D. A. Sleet, R. S. Thompson, D. M. Sosin, J. C. Bolen, and Task Force on Community Preventive Services. 2001. Reviews of evidence regarding interventions to increase use of child safety seats. *American Journal of Preventive Medicine* 21:31–47.

Biographical statements

Chris S. Dula received his doctorate in Clinical Psychology from Virginia Polytechnic Institute and State University (Virginia Tech) in 2003. While there, he worked closely with Dr. E. Scott Geller at the Center for Applied Behavior Systems. Dr. Dula's preliminary examination and dissertation at Virginia Tech and his master's thesis at Appalachian State University were each focused on dangerous driving. He completed a one-year postdoctoral research fellowship focused on traffic safety issues at the University of Memphis, under the direction of Dr. William Dwyer. In the fall of 2004, Dr. Dula began work as a tenure-track assistant professor at East Tennessee State University. He founded the Applied Psychology Laboratory (APL) in the spring of 2005. A number of graduate and undergraduate research associates are currently working on a variety of APL projects and have collectively presented over 40 professional presentations in its first full year of operation. He has been co-Principal Investigator on three grant-funded research projects, totaling over $230,000 and Principal Investigator on several smaller projects totaling almost $30,000 in funding. His research interests include dangerous driving and traffic safety issues, aggression and risk-taking, self-report measure development, and the teaching of research.

E. Scott Geller, Ph.D. For almost four decades, Dr. Geller has taught and conducted research as a faculty member in the Department of Psychology at Virginia Tech. In this capacity, he has authored 27 books, 42 book chapters, 38 training manuals, 198 magazine articles, and over 300 research articles addressing the development and evaluation of behavior-change interventions to improve quality of life. Dr. Geller has been the Principal Investigator for more than 75 research grants, totaling nearly $6.5 million in funding, which involved the application of behavioral science for the benefit of corporations, institutions, government agencies, or communities in general. His Center for Applied Behavior Systems has helped numerous undergraduate and graduate students obtain valuable research experience. He and his students have delivered more than 1,200 research presentations, and he has served as chair of over 40 master's theses and more than 25 doctoral dissertations. His current research interests include industrial health and safety, vehicle and pedestrian safety, environmental protection, and the reduction of medical errors.

A barrier to building a traffic safety culture in America:

Understanding why drivers feel invulnerable and ambivalent when it comes to traffic safety

Karen Smith and John W. Martin

Southeastern Institute of Research (SIR)

Overview

Every day in America, over 100 deaths and 8,000 injuries result from motor vehicle accidents [National Highway Traffic Safety Administration (NHTSA) 2006]. Among those between the ages of 4–34, motor vehicle crashes are the leading cause of death (Subramanian 2006). In addition to personal suffering, the estimated 2004 annual economic cost exceeded 230 billion dollars (NHTSA 2006).

In spite of these facts, Americans still feel surprisingly safe on the roads. According to the U.S. Department of Transportation's Federal Highway Administration, only 5% of people feel that the roads are unsafe (FHWA 2005). Drivers report that they are satisfied with road conditions, as well as enforcement of key safety laws, such as those that pertain to speeding, drinking and driving, and safety-belt use.

The disconnect between the threat of being involved in a serious motor vehicle crash and the perception of safety is puzzling given the frequency of serious and even fatal vehicle accidents. The effective disconnect may be, however, the reluctance—or even inability—of many drivers to assume responsibility for safe driving and safety on the roads. Driving a vehicle is a convenience, a necessity, a habit, and, even, a "right." It makes life better, easier, and more efficient. But, lost somewhere in the taken-for-granted convenience and necessity of vehicles and driving is recognition of the responsibility of the driver to "keep it safe." Drivers often seem not to recognize consciously their own responsibility for driving safely. Failure to recognize this responsibility means they also do not adopt safe driving behavior. The result can be carelessness, lack of attention, failure to use safety belts, excessive speed, driving while talking on their cell phones, and a host of other dangerous habits.

Understanding the "reluctance" of drivers to accept responsibility for safe driving can be addressed by better understanding how drivers "attribute" the cause of accidents. Specifically, this paper examines how drivers who are involved in vehicle accidents are viewed. It asks, "What is the perceived character of drivers who are involved in accidents or who exhibit unsafe driving habits?" Are these people viewed as somehow "different" and as not recognizing the hazards and danger they create? Are they viewed as unfortunate victims of circumstance? Are they viewed as careless or not attentive and, thus, blamed for causing accidents? This paper argues that to avoid the negative self-perception of a "bad" driver, individuals view themselves as safe drivers. In order to align driving behavior with this positive self-perception, drivers exhibit safe or safer driving habits.

This paper uses attribution theory—from its base in social psychology—to develop a framework for understanding how drivers attribute responsibility for auto accidents. It argues that drivers explain why accidents occur by attributing cause or responsibility for an accident. It further examines the extent to which drivers attribute the responsibility for safety to themselves. The fundamental premise is that when drivers attribute the "cause" of accidents to drivers, they also come to attribute responsibility to themselves for driving safely.

The analysis explores how the attribution process "works". In an innovative application of attribution theory, it develops a framework for intervening in the attribution process to impact its outcome. The analysis argues that by redirecting the attribution process away from other drivers or external events (e.g., traffic congestion caused the accident) to themselves, drivers come to recognize and assume responsibility for driving safely. The paper proposes that by intervening in the attribution process, drivers will be less likely to "blame" external situations (e.g., the "other" driver, weather, road conditions, etc.) for accidents and assume a greater sense of responsibility for driving safely. By impacting that attribution process, marketing communications can help drivers come to recognize and accept their own responsibility for safe driving—and, hence, foster the development of a culture of safety. The eventual outcome of this process is to turn the *negativity* of assigning "blame" for an accident to another driver to the *positive* of acceptance of personal responsibility of driving safely or driving more safely. The outcome of this perspective has both heuristic and pragmatic value. It advances understanding of human response to vehicle accidents, and it provides a framework for bringing about driver acceptance of responsibility for safe driving.

Introduction

Traffic fatalities have become an acceptable consequence of modern day mobility. In 2004, 6.2 million motor vehicle crashes resulted in 42,636 deaths and almost 2.8 million injuries. Media stories of motor vehicle related injuries and death are commonplace. Yet, as media reports of vehicle crashes and related deaths accumulate, Americans seem to become more and more desensitized to needless loss of life. Rather than demanding national traffic safety reform, American drivers openly exhibit what statistics clearly suggest are unsafe driving practices—driving without seatbelts, talking on cell phones, speeding through work safety zones, and so forth—putting themselves and others at a greater risk of becoming the next statistic.

Drivers often act as if motor vehicle accidents are events that happen to other people, not themselves. When hearing about horrific accidents, many seem to think that if they were confronted with the same set of circumstances, they would avoid the accident entirely. Those involved in accidents often "blame" the occurrence on someone or something rather than recognizing or accepting personal responsibility. Cause for an accident, for example, is often attributed to the other driver, weather, condition of the roads, construction, vehicle problems, etc. Acceptance of personal responsibility for an accident often seems to be resisted.

This ability to attribute cause and deflect *personal* responsibility when it comes to operating a motor vehicle is a fundamental barrier to cultivating a national safety ethic that prioritizes vehicle and pedestrian safety. To overcome this barrier, transportation and safety administrators, car manufacturers, insurance agencies, and travel related associations must develop a greater

understanding of how people attribute cause and responsibility when it comes to serious motor vehicle accidents and identify ways to make traffic safety messages more relevant and personal. Only when drivers recognize and accept their responsibility for traffic safety will a culture of safety be reality.

A guiding framework for understanding how drivers attribute causes of accidents and responsibility for safety can be found in the tenants of attribution theory. The field of attribution research provides a potentially valuable analytical paradigm for understanding and affecting motorists' concerns and sense of responsibility for vehicle accidents. Attribution research addresses *perceptions* through its focus on the human inclination to look for and identify the causes of events and to make subsequent causal inferences about these events. This perspective is sometimes called "naïve theory" because it reflects the everyday, commonsense explanations that people—lay persons from the perspective of psychology—use to explain events and the world around them. Formal study of the attempt to identify and assign causality is found in the basics of attribution theory.

This paper explores how the attribution process "works" and extends that analysis to use attribution theory to explore how the "blame" for accidents can be redirected to positive self-perceptions and the personal acceptance for driving safely. The paper proposes that by intervening in the attribution process, drivers will be less likely to "blame" external situations (e.g., the "other" driver, weather, road conditions, etc.) for accidents and assume a greater sense of responsibility for driving safely. Since the analysis begins and ends in the attribution process, a more thorough grounding in attribution theory will help to develop the perspective.

Attribution theory

Attribution theory has a long and rich history in the field of psychology and social psychology. It has made important contributions simply because it attempts to account for and explain everyday explanations—explanations that bring order and predictability to a world that might not otherwise be orderly and predictable. Attribution theory (which is actually a group of theories) is all about explanations of "why." "Why am I being ignored?" "Why didn't I get that job?" "Why won't the kids eat broccoli?" "Why was I broadsided on my way to work?" Attribution theory looks for the patterns, consistencies, and outcomes of everyday explanations of "why."

The search for an understanding of causality dates back several thousand years to the insights of Aristotle in his analysis of the types of causes. This perspective is adopted and adapted, as Forsterling (2001) points out, in the works of Hume, Kant, and Mill, whose theories of causality are integral to contemporary psychology. This interest in causality became more explicitly tied to the "naïve theories" of everyday life in the works of Fritz Heider, particularly in his *The Psychology of Interpersonal Relations* (Heider 1958). Heider is generally considered to be the founder of attribution theory. His works were expanded and formalized by psychologists Harold Kelley and Edward Jones throughout the 1960s and 1970s. Psychologists today continue this classic tradition by utilizing attribution theory to help understand human behavior in the work setting, health care, deviance, the marital relationship, educational attainment, alcoholism, and myriad other dimensions of individual well-being and personal attainment.

Attribution theory attempts to understand how people explain and account for causality. It is based upon the premise that individuals are seldom passive observers of events and behavior (Shaver 1975). Rather, they are active perceivers searching for the reasons accounting for what they observe. It classifies attributions according to two fundamental types:

1. External or situational attributions that account for causality by assigning responsibility to external factors (e.g., the weather).
2. Internal or dispositional attributions answer the "why" question by assigning responsibility to the person.

In practice, these two perspectives can produce different research focuses. The first can produce research that addresses control, management, and environmental issues. The second can produce examination of issues related to personality and self-worth. But, this perspective can also produce keen insights related to control, e.g., self-control and behavior change.

The position developed in this paper utilizes attribution theory as a guide to understanding perceptions of unsafe drivers. In doing so, it actually combines these two perspectives of attribution theory. It proposes that by better understanding how people view or perceive those involved in motor vehicle crashes, it will be possible to better communicate with motorists in ways that will help them to manage their own behavior to be better, safer drivers (using self-attribution). To the extent that drivers involved in vehicle accidents are perceived as careless, irresponsible, negligent, or even "bad" people, others will work to manage their own behavior by driving responsibly—and avoiding negative self-perceptions. Attributions that place the responsibility for accidents on "bad" people will produce safe driving habits. Responsibility attributed to others for "causing" accidents can be redirected to develop a sense of responsibility among drivers for "driving safely." In order to develop and maintain positive self-attributions (and, hence, positive self-perceptions), drivers will adopt safe driving habits.

Attributions and behavior

In addition to helping to explain why people act as they do, attribution theory offers a glimpse into how to change driving behavior. Drivers feel they cannot control many external situations, such as poor weather or other drivers. But, they do feel they can control themselves. Consider someone who has a perfect driving record. If he attributes this record to an external source, such as luck, he is less likely to behave in a manner consistent with good driving. If, however, he believes he is a good driver, he is likely to try to act like one—stopping completely at stop signs, following the speed limit, and using turn indicators. The attribution that he is a good driver influences his behavior. Those who accept or feel a sense of responsibility for their behavior will be more likely to behave in a way consistent with that feeling.

Researchers and safety experts have made some—but limited—use of attribution theory in explaining and understanding careless and irresponsible driving. There is, however, research in complementary fields that suggests the value of the application of attribution theory in the role of personal responsibility for the outcome of situations and events. Rothman et al. (1993), for example, studied the role of personal responsibility in the willingness of women to get regular mammograms. In this research, women who had not in the past undergone regular mammograms were shown one of three messages: one that focused on internal attributions, another that focused

on external attributions, and a third that just provided information. Women who were shown the internal attribution message, in which they were given persuasive information emphasizing their personal responsibility for getting mammograms, were more likely than the other groups to have gotten a mammogram one year later. In this instance, strengthening internal attributions has been used to successfully change behavior. Building on this perspective, this paper proposes that attributions can also be used to change driving behavior by creating a sense of personal responsibility for safe driving.

Attributions and traffic safety

Vehicle safety research guided by attribution theory has been somewhat disparate in that a variety of issues and substantive areas have been addressed. But, most often, the research examines the psychological well-being of accident victims, particularly in terms of how they explain the "cause" of the accident. This research asks a fundamental question: "Are accident victims psychologically better if they assign responsibility to themselves for the accident or if they blame others?" Such research tends to be based in health and medical fields and industrial safety, rather than traffic safety. Its focus, ultimately, is the development of support or therapeutic services that help accident victims to better cope with the accident and the outcome of the accident (e.g., paralysis).

Common sense would suggest that attributing responsibility for an accident to the "other" driver would be associated with a stronger self-concept and more positive adaptive behavior. But, research connecting internal or external attribution and adaptation has been somewhat inconsistent and not always clear cut. Most often, this research tends to show that assigning cause to others does not lead to a better sense of well-being. In a review of published studies that have measured external attribution and adaptation to the outcome of accidents and other victimizing experiences, Tennen and Affleck report that assigning cause to others for the accident or victimizing event is related to a lower sense of well-being. In none of the 25 studies they reviewed, did they find blaming others (external attribution) to be associated with more positive attribution (Tennen and Affleck 1990).

A study that focuses specifically on vehicle accidents advances our understanding of the relationship between internal and external attribution and the sense of well being. This seminal study, conducted by Ho et al. (2000), examines how vehicle accident survivors place responsibility for the accident and how well they adapt to the outcome of the accident. This research assesses the effects of motor vehicle accidents on levels of psychological distress and well-being on drivers and passengers and their responsibility attribution. In this study of 321 drivers and passengers involved in motor vehicle accidents, the authors report that only 20% of drivers perceived themselves to be at fault. The other 80% believed they were not at fault. Additionally, the research reported an overall decrease in the feeling of well-being among both drivers and passengers following the accidents. This was particularly important for drivers in that it was linked to their attributions of the cause of the accident. Drivers who did not find fault in themselves—but attributed responsibility to the other driver instead—experienced a greater decrease in their sense of well being. They experienced more psychological distress and a lower level of well being than did drivers who viewed themselves as responsible. Ho et al. conclude that internal attribution

(i.e., self-blame) lessens the emotion of anger. This, in turn, reduces the sense of psychological distress and intrusive negative thoughts. Thus, self-blame actually helps accident victims to cope.

Another study (Stewart 2005) found support for what is called *defensive attribution theory* (DAT). DAT focuses primarily on how people make attributions that make them feel safe. DAT suggests that accident survivors make attributions of responsibility in a way that reduces their experience or sense of vulnerability. In Stewart's research, vehicle accident survivors completed a survey in which they gave attribution ratings to various "causes" of their accident: other drivers, themselves, road conditions/weather. Those who had been in serious accidents attributed greater responsibility to other drivers and environmental conditions. Those in less severe accidents attributed about the same level of responsibility to themselves as to others. Stewart interpreted this to suggest that those involved in serious accidents used the attribution of the cause to others to make them feel "safe" or less vulnerable because they would be unlikely to be traveling under those same circumstances again. Attributing causality to weather or road conditions gave victims a sense of control because they could choose to avoid similar circumstances in the future. But, Stewart also found that those who attributed cause to other drivers were more likely to exhibit avoidance behavior in regard to driving or riding in a vehicle.

A literature review sponsored by the U.S. Department of Transportation, National Highway Traffic Safety Administration, provides additional insight into how people attribute responsibility to victims of car accidents (Eby and Molnar 1998). One course this research follows focuses on the severity of the crash and the attribution of responsibility (for failure to drive safely). Eby and Molnar (1998) report that when alcohol is involved in the accident and when it is not, attributing the cause of the crash tends to reflect the severity of the crash. As crashes become more severe, responsibility is increasingly attributed to victims. When accidents are minor or "near misses", little effort is expended in attempting to attribute causality. This research has produced recommendations for driver training and driver improvement programs that stress teaching students to analyze their own driving behavior in relationship to accidents and near misses—and stresses the need for drivers to assume responsibility for their driving.

Studies of attribution suggest that attributing causality for a motor vehicle accident is a complex process. Self-attribution occurs, but it can be a painful experience. Consequently, people may use attribution to judge themselves differently than they do others or to judge others rather than themselves. There may even be a self-serving bias at work in the attribution process as people tend to attribute good things to themselves and bad things to others or to the situation. This self-serving bias may help explain why people tend to feel invulnerable to car crashes despite the amount of attention these events receive from the media.

The study of accidents, attribution, and personal well-being tends to express two common focuses of concern:

1. Victims of accidents, i.e., individuals who have actually experienced accidents and
2. Psychological outcome experienced by victims

This paper adopts a slightly different focus by utilizing attribution theory for the analysis of perceptions of vehicle accident causality—a perspective that has direct application for the development of a culture of safety. It expands the analysis of attribution by examining the personality and character traits attributed to those who are viewed as causing accidents. This approach sets aside differences between internal and external attribution and assumes that cause

is attributed to someone (i.e., it excludes nonhuman culpability). This approach also assumes that to attribute responsibility for an accident—or driving safely—the individual does not have to experience an accident. They might witness an accident, observe reckless driving, or hear about an accident in the news. By adopting this approach, attribution theory can be used to develop a better understanding of the dispositional attributions made to reckless drivers and drivers who are in accidents—and lead to recognition and acceptance by drivers of their role in vehicle safety.

Extending attribution theory to develop a culture of safety

An important component of the proposed approach is a perspective labeled "person perception" (Shaver 1975). As active participants in interpreting and understanding their world, individuals explain the behaviors of others by attributing reasons, motives, histories, personality traits, and so forth to the other person. Because these "objects" (the observed individuals) are external to the observer, they are referred to as *distal objects* (Shaver 1975). The information needed to account for or explain the behaviors of others (distal objects) is not always available or apparent. Thus, in attempting to explain specific behaviors of others, individuals often categorize or classify people. Categorizing someone as Democrat, friendly, careless, or generous, for example, helps to explain behavior and attribute causality. The ultimate result of this process is a definition and evaluation of the other person that allows the observer to relate to the other. The categorizations and attributions applied to others are guides that provide order, meaning, and predictability to social life.

In the study of vehicle accidents, research has tended to focus on the attributions of those involved in the accidents and the manner in which they have attributed causality. For example, Stewart's (2005) research focused on how drivers attributed crash events to external circumstances rather than their own driving performance at the time of the incident. Beyond identifying the extent to which accident victims attribute responsibility to themselves or to external causes, research has not yet examined in depth the categorizations or classifications of drivers who are responsible for accidents. By extending the attribution analysis beyond the act of attribution to the interpretations and "naïve" psychology utilized to understand those blamed for the accident, the perspective can be used to understand the "kinds" of people who are blamed for accidents.

As illustrated in Figure 1, the attribution sequence begins with the observation of an event or situation. This observation may take place in "real life" in that the observer is actually present in the physical space in which the incident occurs and, thus, witnesses the incident. The observation might also occur more indirectly—such as hearing about an incident (through word-of-mouth, a news report, and so forth) or even imagining it. In either case, the observer does not passively "observe" the incident. He *interprets* the event or incident. Through interpretation, the observer interjects personal views, expectations, values, and past experiences into understanding the occurrence and is thereby able to assign causality.

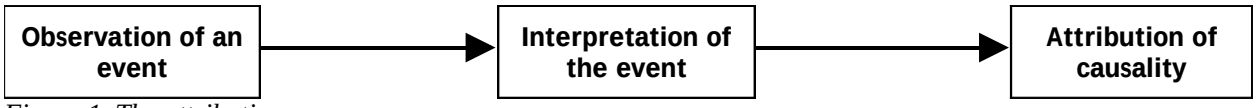

Figure 1. The attribution sequence

This basic process can be defined more explicitly and expanded to incorporate its impact on the observer. The first change to this model is the specification that causality is attributed to a person rather than some environmental factor or combination of factors. To focus on the person rather than the situation is a position well supported by attribution research. Citing work by Nisbett and Ross (1980) and Fiske and Taylor (1984), Haunschild and Sullivan (2002) points out that "there is a tendency to focus on the person, not the situation, as the cause of events." Then, building on the fundamentals of "person perceptions," the model proposes that the observer does more than attribute cause to a person. The observer classifies or even evaluates the person causing the incident. Depending on the outcome or nature of the incident, the other person might be viewed positively, negatively, or even neutrally. The final outcome of this process is self-examination as the observer examines his own behavior in reference to the classification of the other person. This process is diagrammed in Figure 2.

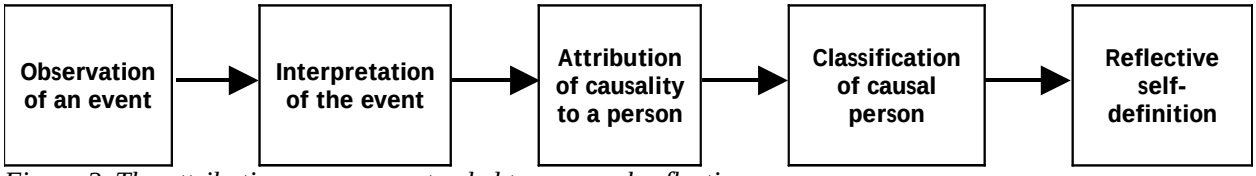

Figure 2. The attribution sequence extended to personal reflection

This expanded model can be applied specifically to vehicle accidents. First, the observer sees (or hears) an accident, either witnessing the accident or hearing about it (e.g., in the news, by word-of-mouth). Then, the accident is interpreted as something "bad"—it's frightening, upsetting, dangerous, and so forth. The observer then looks for and tries several explanations for the cause of the accident. Ultimately, in at least some accidents, the cause of the accident is attributed to the (other) driver and that driver is classified or defined. The (other) driver may be viewed as careless, lazy, negligent, unlucky, and so forth. The final step proposed in this model is observer self-examination. The observer examines his own "driver behavior" in reference to the definition applied to the other driver. To avoid a negative self-concept, the observer does not want to perceive himself as careless, lazy, negligent, and so forth. Instead, he views himself as responsible, diligent, and careful. According to the self-fulfilling prophecy (Merton 1968), the driver who views himself as responsible, diligent, and careful is more likely to behave that way, i.e., to drive responsibly. To the extent that drivers view those who cause accidents negatively, they will attempt to avoid comparable negative self-perceptions by driving safely. This process is diagrammed in Figure 3.

The value of this model extends beyond its potential heuristic contributions to suggest a pragmatic outcome. It suggests that it is possible to impact self-perceptions in such a way as to grow and enhance a culture of safety. Marketing communications can be used to "remind" or educate drivers about the "types" of drivers who cause accidents, such as careless, irresponsible, and negligent drivers. This model of perceptions of the cause of vehicle accidents, based in attribution theory, can be used to develop marketing strategies, tactics, and activities to educate and remind drivers of their role in driving safety. Communications would be used to develop an image of "bad" drivers—by attributing the cause of accidents to carelessness, recklessness, irresponsible drivers, and so forth. As drivers come to "recognize" the negative traits, personality characteristics, and driving habits of "bad" drivers, they also reflect upon their own driving. To avoid a negative self-perception, they view themselves as responsible, careful, attentive, and safe drivers. They attribute accidents to bad drivers, but they avoid negative self-perceptions by viewing themselves as safe drivers. Over time, their behavior (i.e., driving safely) reflects this positive self-perception more and more as drivers align their self-perception and their driving. Thus, as marketing communications succeed, drivers come to automatically think *and* act as safe and responsible drivers, an integral component to a culture of safety.

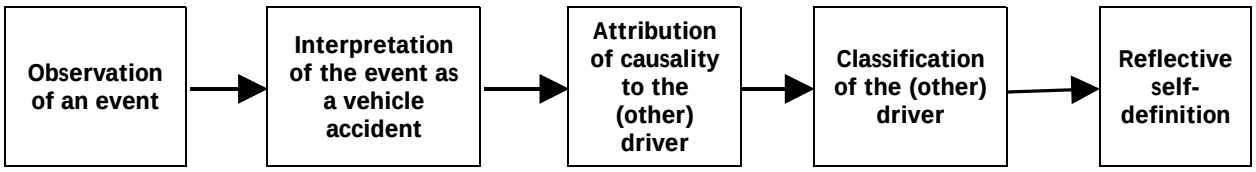

Figure 3. The attribution sequence applied to vehicle accidents

Recommendations

The focus of this paper has been on how attribution theory can be applied to improve traffic safety. Drivers' feelings of invulnerability surely contribute to their feelings of safety on the road. While it is not clear why people feel so safe, given the volume of fatal crashes and serious injuries that occur, it is clear that attribution theory can produce better insight and understanding of these complex issues.

Past research focuses on the attributions of actual car crash victims—how drivers attribute crash events to external circumstances rather than their own driving performance at the time of the incident. This research suggests just how easily drivers can deflect their sense of personal responsibility.

Common sense suggests that this same kind of deflection or attribution happens to many drivers when they are confronted with facts suggesting that driving is dangerous, and, in some cases, deadly. When presented with seemingly unassailable facts that accidents happen, many can simply attribute involvement in accidents to what must be mistakes by the "other driver."

The studies reported in this paper are an excellent foundation for development of an analytic framework that uses attribution theory to create a greater sense of driver safety responsibility. Rather than focusing on those who have already been in accidents, this perspective expands to address drivers in general, whether or not they have been in accidents. It may be easy or

comforting for drivers to deflect responsibility for accidents. But, research into the attribution process suggests that this process can be mediated and its conclusion redirected.

Much remains to be done to bring this perspective to a pragmatic conclusion. The theoretical foundation is sufficiently solid to warrant research into the process of redefining and redirecting the attribution process as it relates to motor vehicle accidents. This research would investigate and identify the common character and personality traits and driving habits that are attributed to drivers whose carelessness or failure to drive safely causes accidents—or drivers who are simply viewed as "bad" drivers. But, the research would also need to identify those attributions that are viewed as most negative or undesirable—particularly in regard to potential self-attribution. Fundamentally, research would need to address the identification of the attributions that are most averse, i.e., the self-perceptions that drivers most want to avoid. Based on this understanding, communications research could be used to develop the most compelling and meaningful messages that can redirect common attributions that produce greater awareness and acceptance of personal responsibility. Ultimately, this investigation could lead to the production of a resource guide for safety campaigns that lists the most compelling messages. Such a reference could help safety professionals better achieve the goal of increased driver safety—the basis of a culture of safety.

Summary

Driver safety is a critical concern. Lives are at stake. Creating a culture of safety in which people hold and express beliefs and attitudes that value vehicle, driver, passenger, and pedestrian safety is increasingly important. Attribution theory provides a powerful lens for getting to the heart of feelings of invulnerability when it comes to traffic safety. The feeling that it "just can't happen to me" is one that must change in order to embrace a culture of safety. Attribution theory can guide the process of becoming a more safety conscious America.

References

Eby, D., and L Molnar. 1998. *Matching traffic safety strategies to youth characteristics: A literature review of cognitive development*. Sponsored by U.S. Department of Transportation, National Highway Traffic Safety Administration.

Federal Highway Administration (FHWA). 2005. *Traveler Opinion and Perception (TOP) survey.* FHWA Office of Professional and Corporate Development.

Fiske, S.T., and S. E. Taylor. 1984. *Social Cognition*. New York: Addison-Wesley.

Forsterling, F. 2001. *Attribution: An introduction to theories, research and applications*. Philadelphia: Psychology Press.

Gidron, Y., R. Gal, and H. S. Desevilya. 2003. Internal locus of control moderates the effects of road hostility on recalled driving behavior. *Transportation Research Part F: Traffic Psychology and Behaviour* 6:109–16.

Haunschild, R., and B. Sullivan. 2002. Learning from complexity: Effects of prior accidents and incidents on airlines' learning. *Administrative Science Quarterly* 47:609–43.

Heider, F. 1958. *The psychology of interpersonal relations*. New York: Wiley & Sons.

Ho, R., G. Davidson, M. Van Dyke, and M. Agar-Wilson. 2000. The impact of motor vehicle accidents on the psychological well-being of at-fault drivers and related passengers. *Journal of Health Psychology* 5:33–51.

Merton, R. K. 1968. *Social theory and social structure*. New York: Free Press.

National Highway Traffic Safety Administration. 2006. *A compilation of motor vehicle crash data from the Fatality Analysis and Reporting System and the General Estimates System*. Accessed online July 3, 2006, from http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/2004HTML/TSF2004.htm.

Nisbett, R., and L. Ross. 1980. *Human inference: Strategies and shortcomings of social judgment*. Englewood Cliffs, NY: Prentice-Hall.

Roesch, S. C., and J. H. Amirkham. 1997. Boundary conditions for self-serving attributions: Another look at the sports pages. *Journal of Applied Social Psychology* 27:245–61.

Rothman, A. J., P. Salovey, C. Turvey, and S. A. Fishkin. 1993. Attributions of responsibility and persuasion: Increasing mammography utilization among women over 40 with an internally oriented message. *Health Psychology* 12:39–47.

Salminen, S., T. Klen, and K. Ojanen. 1999. Risk taking and accident frequency among Finnish forestry workers. *Safety Science* 33:143–53.

Shaver, K. G. 1975. *An introduction to attribution processes*. Cambridge: Winthrop Publishers.

Stewart, A. E. 2005. Attributions of responsibility for motor vehicle crashes. *Accident Analysis and Prevention* 37:681–8.

Subramanian, R. 2006. *Motor vehicle crashes as a leading cause of death in the United States, 2003*. National Highway Traffic Safety Administration's National Center for Statistics and Analysis. Traffic Safety Facts Research Note.

Tennen, H., and G. Affleck. 1990. Blaming others for threatening events. *Psychological Bulletin* 108: 209–32.

Biographical statements

Karen Smith, Ph.D., is SIR's Senior Vice President of Research Strategy. With more than twenty years of experience conducting research for some of the nation's (and the world's) leading corporations and organizations, Karen is responsible for all phases of SIR's research—from problem conceptualization and research design to analysis and strategic interpretation of results. Karen works across a variety of industries, including healthcare, transportation, manufacturing, education, associations, consumer products, business-to-business, and finance.

John W. Martin is the President and CEO of SIR. Prior to SIR, John led the marketing and marketing research efforts of PBM Products, a consumer products company specializing in nutritional products. While at PBM, John orchestrated new product launches and promotional programs with leading retailers including Wal-Mart, Target, Kroger, Albertson's, CVS, and dozens of other national chains. During John’s tenure as PBM’s chief marketing officer, the company became one of the fastest growing private companies in America.

John began his career at a mid-Atlantic advertising agency, where as President he led the agency's planning and research work in healthcare, B2B services, and travel marketing. Many of John's initiatives while at the agency received the American Marketing Association's (AMA) Effie Award, for the most effective marketing campaigns in the country.

John received a master's of business administration from Virginia Commonwealth University in 1984 and graduated from Washington & Lee University with a bachelor's degree in economics in 1982. John is often a featured speaker at marketing workshops around the country and most recently addressed the Southern Newspapers Publishers Association annual conference.

Supporting highway safety culture by addressing anonymity

James W. Jenness

Overview

The purpose of this paper is to stimulate thinking and research about neglected approaches to traffic safety that are outside of typical engineering or law enforcement practices. These approaches include the study of social, cultural, and other motivational factors that play a role in traffic-safety culture. Not only do these factors affect drivers' behavior, they also affect public attitudes and political support for highway-safety research and implementation of countermeasures. A better understanding of social and cultural motivations underlying drivers' behavior ultimately may lead to improvements in traffic safety. To illustrate the type of approach advocated, the topic of anonymity is discussed in relation to drivers, highway workers, and crash victims. Research in social psychology has shown how anonymity may affect people's behavior in several ways, and a few studies have addressed the effect of anonymity on driver's behavior. Although further research is needed to evaluate the benefits of reducing anonymity, several possible strategies are discussed here.

Introduction

Safety engineering in the design of motor vehicles and roadway infrastructure often includes human factors analyses to understand, enable, facilitate, and control driver behaviors. Typically, human factors research has focused on topics related to drivers' motor skills and perceptual abilities (including risk perception, attention, and cognitive processing), and overall workload necessary for vehicle control and navigation, but generally it has ignored interactions between roadway users. The disciplines of social psychology and sociology which have proven useful for explaining and predicting human behavior in many nondriving contexts also could be applied to improving highway safety. However, these disciplines have only rarely addressed any social psychological aspects of driving behavior. In fact, a survey of sixteen English-language social psychology texts dating from 1938 to 1977 found only a single index entry under the headings "automobile", "cars", or "driving" (Knapper and Cropley 1980).

In the United States, automobiles have been marketed as a symbol for individual freedom, speed, fun, and the ability to travel to scenic locations. Car advertisements often feature a single vehicle on an open road (and only in the small print do the ads disclaim, "Professional driver on a closed course—do not attempt."). In reality, many areas of the country have high traffic densities, where safe driving is a cooperative social experience that requires respect for other road users and observance of traffic-control devices, traffic laws, and cultural norms. For example, at intersections controlled by four-way stop signs, drivers cooperate with others by noticing when they have stopped relative to when other drivers have stopped, and then they each proceed in an orderly fashion when it is their turn to do so, but only if there are no pedestrians crossing the street in front of their vehicles. Cooperation is also required at roundabouts, merges, multilane

turns, and many other situations. Various cooperative driving behaviors are culturally specific. As compared to drivers in the United States, drivers in Germany show greater respect for the (left) passing lane and willingly yield it to drivers who approach from behind and flash their lights. Drivers in Mexico City seem more comfortable with close following distances and are adept at using every inch of the travel lanes during periods of congestion. While taxis, automobiles, and trucks continuously negotiate their way into and out of crowded vehicle queues, motorcyclists ride skillfully through the middle of the crowd on the lane markings. In Japan, drivers nearly always use turn signals when changing lanes, and, when merging into a queue, it is customary for the driver to say, "Thank you," by briefly activating his four-way flashers (emergency lights). All of these behaviors are forms of social interaction that occur on the roadways.

Effects of anonymity on behavior

In this paper, the terms "anonymity" and "anonymous" are applied broadly (and somewhat loosely) to describe the fact of being unidentified, the self perception that one is unknown, and the feeling of being socially isolated from others. Anonymity is not discussed here as an "all or none" state. Thus, reducing anonymity means simply to reveal some information about a person, but not necessarily to reveal that person's identity. Drivers are rarely completely anonymous in the strictest sense of having an untraceable, unknown identity because their vehicles have unique license plates which are registered in a state database. In fact, some drivers have pseudonyms in the form of vanity plates, while other drivers publicly reveal information about themselves and their families through bumper stickers, various ornamentation hanging from the rear-view mirror, displays of stuffed animals or baseball caps in the rear window, etc. Despite these mild forms of self-expression, as traffic congestion in the United States continues to increase, many drivers find themselves spending an increasing amount of time as socially isolated, undifferentiated members of uniform crowds. The anonymity that drivers experience has been reflected in popular culture. For example, the recent animated film, "Cars" (Anderson, Lasseter, and Ranft 2006), is a story involving anthropomorphic vehicles that exist in a place where human drivers are never seen and play no role at all.

Anonymity and automobile design

Before Henry Ford applied assembly-line manufacturing processes, automobiles were ordered from custom coachbuilders. They were expensive status symbols that expressed the individual taste of the owner. Marsh and Collett (1986) explain that Ford's assembly line for the Model T produced a car that was more accessible to the masses, but more standardized in its design. For instance, due to difficulties in producing durable automotive paints, color was not an option. In those days, Mr. Ford's strategy was, "Give the customer any color he wants so long as it is black." Today, customers have limited choices over factory options, such as color, but very few cars are unique.

In recent decades, concerns about fuel efficiency have led automobiles to become more aerodynamic, and body designs have converged to a small number of vehicle shapes. As a result, the automobile fleet is rather homogeneous. It is difficult to spot one's car in a large parking lot because so many cars look similar. Except for the small number of people who opt for custom paint jobs, vehicle modifications, or older (perhaps "classic") models, most drivers occupy vehicles that blend in completely with other traffic. Few people can be uniquely identified by the cars they drive. This is slightly awkward for modern law enforcement systems. Automated red-light cameras target vehicle owners rather than violators per se. When a vehicle's license plate number is captured clearly by a red-light camera, the identity of the violator is unknown. The registered vehicle owner is responsible for paying the fine. As is the case for parking violations, it seems that the automobile rather than the driver has been cited for the offense. In situations where it may be difficult to track down the driver of the vehicle, the offending driver may feel that he or she is anonymous and may be reluctant to accept responsibility for the offense. Surely many people, feeling unidentifiable, have been tempted to ignore a parking ticket received when they were driving a rental car or failed to leave a note when they hit someone else's parked car.

Automobile designs encourage isolation from other drivers and from the roadway environment. Automobiles often have been designed and marketed so that drivers and passengers would feel at home in their vehicles. Marsh and Collett (1986) point out that similar marketing messages have been used to sell automobiles at least since the 1940s, when slogans were used, such as "The '49 Ford is a living room on wheels." More recently, Johnson Controls used the living room theme in their Kion concept interior, which was unveiled at the 2000 Paris Auto Show. It was described as a "home away from home" where time spent in the car could be used to work, surf the Internet, make phone calls, or simply relax (PRNewswire 2000). One author, commenting on trends in recent model automobiles noted that, "[…] as the driving experience becomes more insular—almost cocoon-like with tinted windows for extra privacy and security—people begin to feel empowered and anonymous" (George 2006).

Feelings of being "at home" in one's automobile may lead to territorial feelings and beliefs that extend outward beyond the vehicle to the immediate highway "neighborhood" (Richman 1972). The driver's sense of personal space is expanded to the outer shell of the vehicle and beyond. Most drivers are highly annoyed if another driver encroaches on this personal space by following too closely, or drifting slightly over the lane lines. In these situations, feelings of territorial violation may be accompanied by legitimate safety concerns about the vehicles colliding, etc. However, to illustrate that driver's personal space is a valid construct, consider the following situation which involves very low risk of injury from a crash—*Suppose that you were stopped at a traffic signal and an unknown driver behind you slowly crept forward until his front bumper just barely touched your rear bumper? Would you feel uncomfortable? Would you feel threatened?* Now imagine yourself carrying out this maneuver on another unknown driver stopped ahead of you. Most people would feel extremely uncomfortable about doing this.

Between drivers who know each other, the size of personal-space buffer zones may be smaller than between drivers who are anonymous. For example, based on their behavior it is fairly easy to identify pairs or trios of vehicles on the highway that are apparently traveling together. The drivers' behavior is similar (speed, lane changes, etc.) and usually, the drivers traveling together maintain closer following distances between themselves than they do with other traffic. The

point of these examples is that drivers' behavior is influenced by many of the same types of social forces that mediate cooperative and competitive interactions among people everywhere.

Social psychology of anonymity

The research literature in social psychology shows that people behave differently when they are anonymous or when those with whom they interact are anonymous as compared to situations where they are identified. The effects of anonymity may be particularly strong when people are in groups. The studies summarized in the sections below relate to anonymity and aggression, and may be applicable to safety discussions about drivers' behavior. There are many other studies (not reviewed here) that have been conducted by social scientists to understand how anonymity can affect altruistic behaviors and people's responses to victims. Although not discussed here, research on these topics is relevant to understanding public perceptions of crash victims and public support for safety programs.

In a series of studies on obedience and disobedience to authority, Milgram (1965) showed that participants were more willing to carry out orders from an experimenter to administer high levels of shock to a fellow participant when they could not see or be seen by the victim. Similarly, the degree of anonymity between the experimenter and the participant strongly affected the participant's behavior. In conditions where the experimenter was never seen, the participant was much less likely to carry out his orders. A similar effect of anonymity was seen under some, but not all conditions in a study of interracial aggression (Donnerstein, et al. 1972). White male participants administered less intense shocks to a Black target individual when they were known to their target than when they were led to believe that they were aggressing anonymously. However, when paired with a White target individual, the White participants delivered equally high levels of shock in face-to-face and anonymous conditions. This study was conducted on a university campus at a time when racial tensions between Blacks and Whites were high. The authors concluded that the observed effect of anonymity reflected the White participant's fear of retaliation from the Black target individual.

Social psychologists seeking to explain the conditions under which normally law-abiding individuals may engage in antisocial behaviors when in groups have described a process called deindividuation. Deindividuation refers to the loss of a person's sense of individuality and an accompanying loss of the normal constrains against antisocial behavior (Zimbardo 1969). Various environmental factors that create anonymity (such as being in a large crowd or wearing a mask or hood) contribute to deindividuation. In studies of aggressive behavior, men are usually more aggressive than women, however; Zimbardo (1969) found that women who were dressed in baggy white coats and hoods and who remained anonymous (deindividuated condition) consistently administered much longer durations of shock to other individuals than women who wore large name tags and were encouraged to interact with each other (individuated condition). Similar results were found by Lightdale and Prentice (1994). In this study, men were more aggressive than women in an individuated condition; however, in a deindividuated (anonymous) condition, the women were just as aggressive as the men.

For many people, being unidentifiable may release their normal inhibitions against engaging in impolite, antisocial, or unlawful behavior. When college students were simply asked what they would do if they could be totally anonymous (and invisible) for twenty-four hours, their most frequent response was to "rob a bank" (Dodd 1985; cited in Brehm and Kassin 1996).

Children also have been shown to be affected by variables associated with deindividuation (Diener, et al. 1976). A naturalistic study of was conducted with over 1300 children who were trick-or-treating on Halloween. The children were told that they could take a single piece of candy from a bowl but were given the opportunity to steal other candy and money. Significantly more stealing occurred when the children remained anonymous than when the children were asked to identify themselves, and more stealing occurred in the presence of a group than when children were alone. Also, the increase in stealing associated with being anonymous rather than identified was much greater in the group condition than in the individual condition.

Anonymity is often mentioned in discussions of aggressive driving and road rage where aggression is said to be encouraged by the sense of anonymity that drivers feel while in their vehicles (e.g., Shinar 1998). People may be more willing to engage in antisocial behaviors when they are in their vehicles than when they are not. For example, people almost never cut in on one another while standing in lines at the grocery store, but they may do so when driving in traffic on the way home, even though the time saving in traffic may be just a few seconds. One focus-group participant described the situation this way, "Talking about people jumping queues, in a supermarket you don't really get it but in a traffic jam you do. People don't care; they just want to get there a little bit faster." (U.K. Department for Transport 2006, p 24). Drivers who are in anonymous groups may show a tendency to violate traffic laws more often than drivers who are alone. Yinon and Levian (1995) found that drivers who were observed waiting at a traffic light were more likely to violate the law by entering the intersection before the light turned green when there were other drivers present.

Horn honking as a measure of aggression and the effect of anonymity

Ellison, et al. (1995) studied drivers' responses to other drivers who were blocking their way at an intersection. In this field study, the visibility of the blocking driver was manipulated to alter his or her degree of anonymity. The blocking driver was an experimenter who drove either a Jeep or a convertible. On each trial, the blocking driver positioned his or her vehicle first in line at a red traffic light. On some trials, the blocking vehicle's top was up and in other trials the blocking vehicle's top was down. On each trial, the blocking driver frustrated the following driver by remaining stationary after the traffic light had changed to green. Drivers' reactions depended upon the degree of anonymity of the blocking driver. When the blocking vehicle's top was up, increasing the degree of anonymity, the following drivers honked their horns sooner and more frequently than when the blocking vehicle's top was down. Besides anonymity of the blocking driver, several other variables have been studied using the blocking-vehicle paradigm. Horn-honking responses have been shown to depend on the sex of the blocked driver (Doob and Gross 1968) and the sex of the blocking driver (Deaux 1971), the social status of the blocking driver (Doob and Gross 1968), and cell phone use by the blocking driver (McGarva, Ramsey, and Shear 2006).

Turner, Layton, and Simons (1975) used the blocking-vehicle paradigm to study how anonymity of the blocking driver may interact with other cues that may influence aggression. In this study the blocking driver drove a pickup truck. A curtain hanging in the rear window of the pickup

truck was open on some trials and closed on other trials. The pickup truck also had a gun rack in the rear window that was always visible, even when the curtain was closed. On some trials, the gun rack held a rifle and on other trials it did not. Also, when the rifle was present, it was paired with a bumper sticker that said either “Friend” or “Vengeance.” These words were chosen to alter the perceived aggressiveness of the rifle. The closed curtain significantly increased the rate of honking across all conditions as compared to the open curtain treatment. The highest rate of honking was observed when the blocking driver was not visible but the rifle and the “Vengeance” bumper sticker were visible.

The horn-honking studies discussed above addressed how drivers’ behavior toward other drivers depended on the degree of anonymity of the other drivers. Anonymity of the driver also has been shown to affect driving behavior. One such study was conducted by Ellison-Potter, Bell, and Deffenbacher (2001). Prior to beginning a driving-simulation task, participants were either instructed to imagine that they were anonymous—“You are to imagine that you are driving a convertible with the top up and other motorists can identify your car but no one can personally identify you.”—or they were instructed to imagine that they were identifiable—“You are to imagine that that you are driving a convertible with the top down and other motorists can personally identify you.” As expected from the social psychology literature, those who were in the anonymous condition drove more aggressively than did participants who were identifiable.

Anonymous but similar people

Among people who are anonymous, even a small amount of revealed personal information can alter social behaviors. People who share similar attributes tend to be grouped together, and knowledge of shared attributes can produce weak social bonds between people who are otherwise strangers. In fact, a shared attribute that is sufficient to form a social bond can be minimal. Miller, Downs, and Prentice (1998) showed that young women cooperated more with a (fictitious) opponent in a Prisoner’s Dilemma game when they were led to believe that they shared the same birthday with the unseen individual. It is likely that weak social bonds form between drivers with similar vehicles (e.g., motorcycle riders, Corvette drivers, truckers, people with the same state license plates who are in another state far from home). It is not known how strongly and in what ways such affiliations may affect driving behavior. Perhaps drivers are simply more polite to those who share some of their attributes, or perhaps drivers are more willing to help similar drivers who are in need (e.g., stopping to assist a driver with a disabled vehicle or stopping after witnessing a crash).

People may behave more responsibly in the presence of others who can identify them. For example, drivers may be more courteous when driving on a street in their neighborhoods or in parking lots at their place of work where they may know people than in other locations where they probably don’t know people and are anonymous (e.g., shopping center parking lot).

Possible down side of making drivers more identifiable

Before making recommendations on ways to reduce anonymity in order to improve traffic safety, it should be noted that reducing the anonymity of drivers may have unintended consequences. The following example illustrates a rare circumstance where certain drivers were less safe because they were partially identifiable.

In Florida during the early 1990s there was a series of violent crimes against tourists, including a German tourist, Barbara Meller Jensen, who was robbed and beaten to death (Kidwell and Garcia 1993). Criminals had specifically targeted tourists whose vehicles could be easily identified as rental cars. Drivers from out-of-town were identifiable because in the late 1980s and early 1990s, rental cars in Florida displayed license plates ending in the letters "Y" or "Z." Until 1991, when they were banned in Dade county, rental cars in Miami often carried stickers or a front tag advertising the name of the rental car company. Ms. Jensen had both a "Z" rear license plate and a rental car company tag mounted on the front of her rental car. Thus, although reductions in the degree of anonymity of drivers may improve the traffic-safety culture overall, certain identifying information may be exploited to commit unlawful acts. Drivers who choose to personalize their vehicles may be subjected to prejudice or may become victims of aggression.

General privacy concerns may limit efforts aimed at reducing anonymity. With the development of advanced Intelligent Transportation Systems (ITS) technology, including the potential for vehicle-to-vehicle communication, vehicle to infrastructure communication, and crash avoidance, the protection of drivers' privacy and access to personally identifiable information will become an issue. Although drivers may not mind exchanging some data with other drivers, it may be important for individual drivers to retain control over how much information they share.

Recommendations (How to move forward)

Reducing the degree of anonymity among roadway users may be an effective catalyst to improving safety culture on the highways. Specifically, a programmatic approach could be developed (as outlined below) to reduce anonymity of drivers, highway workers, convicted traffic offenders, and crash victims. Such a program is expected to change people's perceptions, attitudes, and behaviors, ultimately producing cultural change in the direction of improved safety.

Workshop

As a first step, a multidisciplinary workshop could be held to focus on the concept of anonymity as it relates to traffic safety. This focused topic may be more productive than a more general topic, such as principles of social psychology on the roads. Participants would include a panel of experts, including social psychologists, sociologists, cultural anthropologists, and political scientists who would be able to bring a fresh perspective to highway safety. The purpose of the workshop would be to identify the most promising strategies for improving traffic safety culture. Some candidate strategies are discussed below.

Potential strategies for reducing anonymity among drivers

Although it may be difficult to reduce the anonymity of drivers, some approaches are possible. Promoting increased personalization of vehicles may be beneficial in at least three ways:

1. Drivers whose vehicles reveal some personal information about themselves (i.e., preferences for sports teams, musical groups, support for charitable or political causes, etc.) may feel less anonymous and may be less susceptible to deindividuation.
2. Increased personalization of vehicles may cause drivers of those vehicles to be perceived as individuals rather than as anonymous obstacles.
3. Personalization of vehicles may increase the formation of weak social links between drivers who notice that they share some attribute.

Certainly, many drivers may prefer to remain anonymous and would not like to reveal any information about themselves through their vehicles; however, the popularity of Internet-enabled social networks such as MySpace.com, media sharing sites such as Flickr.com, and self-publishing on the Internet (e.g., though "blogs") indicates that there are millions of people in the United States who are willing to share certain personal information with strangers. The sociocultural changes that are occurring because of the Internet (including the increased comfort level that many people feel about communicating with the public) have the potential to influence automobile culture as well. Some consumers may want vehicles that allow for greater self-expression. Perhaps, a vehicle that outwardly expressed the emotional state (mood) of the driver would have traffic-safety benefits.

Current efforts to develop automatic vehicle-to-vehicle communications technologies are focused primarily on immediate crash avoidance. However, including driver-to-driver communications capabilities in these systems may be helpful for reducing anonymity and allowing drivers to better understand each other's intentions. For example, drivers may use vehicle-based systems to communicate personalized preprogrammed messages to request lane changes or, perhaps, to apologize for minor driving mistakes. To provide a net safety benefit, any such driver-driver communication systems must be simple to use and must not distract drivers from their primary driving tasks.

Strategies that rely on monitoring drivers' behavior may be effective for improving the safety of certain groups. For example, teen drivers (who, compared to older, more experienced drivers are especially high risk) could be monitored by their parents. Operators of fleet vehicles may be monitored by the company that employs them. There are already several consumer products available to monitor and record certain driving parameters which are indicative of unsafe driving. Some of these include cameras that record the driver's face. Insurance companies may be interested in monitoring the driving behavior of people whom they insure. For example, Progressive Auto Insurance has conducted trial programs in Ohio and Texas. Less invasive monitoring strategies rely on reporting by other drivers. Many companies put signs on their vehicles, such as, "How's my driving?" and provide a phone number for other motorists to report poor driving.

Increasing awareness of the effects of anonymity on behavior

In addition to strategies aimed at reducing driver anonymity, drivers could be informed about the potentially dangerous behavioral changes that often accompany feelings of anonymity. Public service announcements (PSAs) might compare the anonymous driving context to more proximate and personal interactions between people. For example, one such PSA might show someone butting into a line of people, shoving them, getting on a cell phone and bumping into people, telling the person in front of them to hurry up, etc. While those behaviors look unacceptably rude and absurd, a driver would be shown (maybe the same person who was deeply offended while waiting in line) doing analogous things while driving. If effective, such messages could broadly affect safety behavior and reduce public tolerance for aggressive driving.

Potential strategies for reducing the anonymity of violators

This approach would attempt to provide a stigma for dangerous driving behavior and a public intolerance for other drivers violating one's right to safety. Names of drivers convicted of DUI, reckless driving, or other serious driving offenses may be published in local newspapers or on the Internet. Alternatively, a "scarlet letter" approach (Hawthorne 1850) may be used where violators are required to display something on their vehicles to identify them as offenders (e.g., tag on license plate). Public identification by a mark on the vehicle would reduce the anonymity of violators and would provide a warning to those who share the road with dangerous drivers. For many convicted violators, this public identification would provide an embarrassing stigma. It may cause some drivers to drive more safely out of fear that the identifier could make them a more likely target for enforcement.

In Washington and Oregon, one form of the "scarlet letter" approach was implemented to discourage offenders from continuing to drive despite being unlicensed or having a suspended or revoked license (U/S/R drivers). Neuman, et al. (2003) has described how the program worked: In this program, the vehicle registration of the vehicle driven by the U/S/R driver was cancelled, and the annual renewal sticker on the license plate was covered by a striped "zebra" sticker. If the vehicle owner was not the offender, then the owner had a 60-day period in which to pay a fee and purchase a new renewal sticker to cover the zebra striped sticker. If the vehicle owner was the offender, then the vehicle registration could not be cleared until the offender's driver's license was reinstated. In this case, the zebra striping remained on the renewal sticker. For law enforcement officers, seeing a zebra sticker on a vehicle's license plate was considered probable cause to stop the vehicle and check the status of the driver's license. In Oregon, the strategy was shown to be effective, but the laws were eventually rescinded in both Washington and Oregon. The effectiveness of the program depends on placing stickers on any vehicle operated by the offender, even if he or she is not the owner. Thus, in Oregon almost half of the stickered vehicles

were not owned by the offender. This situation evidently caused much embarrassment for other family members who must operate the stickered vehicle.

Public identification of offenders may provide an inroad for making the general public less tolerant of risky drivers because it helps promote a sense that there is a specific inconsiderate individual behind the act, rather than just a general sense that "traffic" is aggressive. Efforts could be made to address this as a personal-rights issue, in much the way the risk of "second-hand smoke" is now perceived: Unlawful driving endangers the welfare of all road users. "Scarlet letter" strategies may work by reducing public complacency for the risky actions of other drivers, by providing a social stigma for being such a violator and by alerting other drivers to the presence of nearby offenders who may pose a safety risk.

Potential strategies for reducing the anonymity of highway workers

Highway workers often work in close proximity to moving traffic and protecting them from careless drivers is a major workplace safety concern. Pennsylvania DOT and several other states and municipalities have posted signs in association with highway work zone signs that say, "My Daddy works here" or "My Mommy works here." The font on these signs resembles a child's hand writing. If drivers recognize that highway workers are real people (like themselves) who have families, jobs, etc., they may show them more respect by moderating their speeds and driving more carefully in highway work zones. However, the present author was not able to identify any evaluations of the effectiveness of these signs.

Public service announcements and other messages in the media also may be helpful for personalizing highway workers. The American Road and Transportation Builders Association Transportation Development Foundation (ARTBA-TDF) has sponsored a "Highway Worker Memorial Scholarship Program" to help children of highway workers who have been killed or permanently disabled in the line of duty. Publicity about such programs may have a positive indirect effect on work zone safety, both by personalizing highway workers and by making the driving public more aware of the dangers that highway workers face while they are on the job.

Other creative solutions to personalize highway workers and make them seem less anonymous could be developed. One such solution might include name tags perhaps in the form of changeable magnetic signs posted on the approaches to work zones that list the first names of the workers on duty each day. Workers' reflective safety vests might also include their first names or their initials printed in large letters. All of these ideas have the potential to change drivers' perception of highway workers from that of anonymous agents who cause traffic congestion to real people who are working to improve driving conditions on the highway.

Potential strategies for reducing the anonymity of crash victims

Waitresses often write their name on the customer's check, and people who clean hotel rooms often sign their name on a small card left in the room to increase the amount of tips that they receive. Customers are often more generous when those serving them simply identify themselves in this way. In general, people are also more sympathetic and more generous toward identified victims than toward statistical victims who have yet to be identified. This suggests that strategies which reduce the anonymity of victims may be effective for garnering public support for highway-safety improvements. For promoting traffic-safety culture, local statistics, and community-based programs where the victims have less social distance from members of the community, may be more effective than national statistics and national programs.

Approximately 40,000 traffic fatalities occur each year in the U.S. and families of loved ones killed in crashes sometimes place roadside memorials (crosses, flowers, pictures, and personal items). These informal signs may help to personalize the victim, and provide a warning to drivers, although they also might distract drivers. The net safety benefit of informal roadside memorials is not known. However, some jurisdictions (e.g., Sacramento, CA) have formalized roadside memorials by allowing the families of victims to sponsor official roadside signs containing a safety message and victim's name (e.g., "Please don't drink and drive."—"In memory of <name>"). Other creative, possibly more effective, methods could be developed for families to publicize information about victims. Over time, providing much greater levels of organized support for the families and friends of those killed or injured in crashes to testify publicly about their experiences may influence public perceptions about highway safety and may increase political pressure for safety-related legislation and funding priorities.

In some jurisdictions, victim panels have been used to educate DUI offenders about the possible consequences of their actions. Family members who have lost a loved one or people who have been severely injured as a result of a crash involving a drunk driver are given the opportunity to tell their stories, sometimes in face-to-face meetings with DUI offenders. The risks of driving under the influence of alcohol are made salient to offenders by reducing the anonymity of the victims.

Conclusions

Improving the safety culture of the United States highway system may be aided by research and programs aimed at social factors of driving. Recruiting social psychologists, sociologists, and other social scientists to collaborate on the problem is a first step. One possible approach discussed in this paper is to reduce the anonymity of road users. Several suggestions are offered here to personalize or identify individual drivers, highway workers, or crash victims. Research is needed to explore the effectiveness of these approaches. Although many of the strategies discussed may require sustained efforts over a long period of time to be effective, other public health efforts such as reducing the number of people who smoke have been successful at producing lasting cultural changes.

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References

Anderson, K. (Producer), J. Lasseter (Director), and J. Ranft (Co-Director). 2006. *Cars*. [Feature film], Burbank, CA: Walt Disney Pictures.

Brehm, S., and S. Kassin 1996. *Social psychology*, Third Edition, Boston: Houghton Mifflin Company.

Deaux, K. K. 1971. Honking at the intersection: A replication and extension. *Journal of Social Psychology* 84:159–60.

Diener, E., A. L. Beaman, S. C. Fraser, and R. T. Kelem. 1976. Effects of deindividuation variables on stealing among Halloween trick-or-treaters. *Journal of Personality & Social Psychology* 33:178–83.

Dodd, D. 1985. Robbers in the classroom: A deindividuation exercise. *Teaching in Psychology* 12:89–91.

Donnerstein, E., M. Donnerstein, S. Simon, and R. Ditrichs. 1972. Variables in interracial aggression: Anonymity, expected retaliation, and a riot. *Journal of Personality & Social Psychology* 22:236–45.

Doob, A. N., and A. E. Gross. 1968. Status of frustrator as an inhibitor of horn honking responses. *Journal of Social Psychology* 76:213–8.

Ellison, P. A., J. M. Govern, H. L. Petri, and M. H. Figler. 1995. Anonymity and aggressive driving behavior: A field study. *Journal of Social Behavior and Personality* 10:265–72.

Ellison-Potter, P., P. Bell, and J. Deffencacher. 2001. The effects of trait driving anger, anonymity, and aggressive stimuli on aggressive driving behavior. *Journal of Applied Social Psychology* 31: 431–43.

George, L. 2006. It's not just a car anymore...it's a home. Macleans.Ca, *Business*, February 27, 2006. http://www.macleans.ca/topstories/business/article.jsp?content=20060227_122314_122314 [Downloaded October, 22, 2006].

Hawthorne, N. 1850. *The Scarlet Letter.* Boston: Ticknor, Reed & Fields, 1850; Bartleby.com, 1999. www.bartleby.com/83/. [Downloaded on August 15, 2006].

Kidwell, D. and M. Garcia. 1993. "Alamo" tag marked victim's rental car. *The Miami Herald*, April 6, 1993, 1B Local, Final Edition.

Knapper, C., and A. Cropley. 1980. Interpersonal factors in driving. *International Review of Applied Psychology* 29:415–38.

Lightdale, J. R., and D. A. Prentice. 1994. Rethinking sex differences in aggression: Aggressive behavior in the absence of social roles. *Personality and Social Psychology Bulletin* 20:34–44.

Marsh, P., and P. Collett. 1986. *Driving passion: The psychology of the car.* Boston, MA: Faber and Faber.

McGarva, A., M. Ramsey, and S. Shear. 2006. Effects of driver cell-phone use on driver aggression. *The Journal of Social Psychology* 146*:*13–146.

Milgram, S. 1965. Some conditions of obedience and disobedience to authority. Human Relations 18: 57–76.

Miller, D. T., J. S. Downs, and D. A. Prentice. 1998. Minimal conditions for the creation of a unit relationship: the social bond between birthday mates. *European Journal of Social Psychology* 28: 475–81.

Neuman, T., R. Pfefer, K. Slack, K. Hardy, and P. Waller. 2003. *NCHRP Report 500 Guidance for implementation of the AASHTO strategic highway safety plan. Volume 2: A guide for addressing collisions involving unlicensed drivers and drivers with suspended or revoked licenses*. Washington, DC: Transportation Research Board.

PRNewswire. 2000. Johnson Controls' Kion concept interior showcases "home away from home" interior at Paris auto show. http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/09-28-2000/0001324953&EDATE= [Downloaded October 22, 2006].

Richman, J. 1972. The motor car and the territorial aggression thesis: Some aspects of the sociology of the street. *The Sociological Review* 20:5–27.

Shinar, D. 1998. Aggressive driving: the contribution of the drivers and the situation. *Transportation Research* Part F, 1:137–60.

Turner, C. W., J. F. Layton, and L. S. Simons. 1975. Naturalistic studies of aggressive behavior: Aggressive stimuli, victim visibility, and horn honking. *Journal of Personality and Social Psychology* 31: 1098–107.

U.K. Department for Transport. 2006. Respect on the road: Qualitative research to explore public attitudes towards, and participation in, antisocial behavior on the roads. [Downloaded on October 22, 2006] www.dft.gov.uk/stellent/groups/dft_rdsafety/documents/pdf/dft_rdsafety_pdf_611837.pdf.

Yinon, Y., and E. Levian. 1995. Presence of other drivers as a determinant of traffic violations. *The Journal of Social Psychology* 135:299–304.

Zimbardo, P. G. 1969. The human choice: Individuation, reason, and order versus deindividuation, impulse, and chaos. In Arnold, W. J., and D. Levine eds. *Nebraska Symposium on Motivation* 17: 237–307. Lincoln: University of Nebraska Press.

Biographical statement

Dr. James W. Jenness is a Senior Research Scientist in Westat's Transportation and Safety Research Group. He holds a Ph.D. in Biopsychology (University of Michigan, 1992) and has over fourteen years of experience in behavioral research, particularly in the areas of visual perception, in-vehicle technologies, computer-based training, and auditory communications. Dr. Jenness was a Research Associate in the Visual Sciences Center at University of Chicago (1992–1995) where he conducted studies on color perception and visual adaptation. For five years

(1995–1999) he was assistant professor of Psychology at The College of Wooster (OH) where he taught courses in psychology, statistics, and experimental design. Dr. Jenness worked on product research and development at Beacon Publishing Group, The Dot Com Group, and SS8 Networks where he was Principal Investigator, and then Manager of Human Factors. While at SS8 Networks, Dr. Jenness lead usability tests and user interface design activities for telephone messaging products. He has designed and tested auditory user interfaces for telephone messaging systems, including a TDD/TTY user interface for hearing impaired users. Dr. Jenness also lead behavioral studies of driver distraction caused by cell phone use. Since joining Westat in 2003, Dr. Jenness has managed human factors research projects for Federal Railroad Administration, National Highway Transportation Administration, Washington Metropolitan Transit Authority, and others. Recently, Dr. Jenness was the principal investigator for a behavioral study funded by the Federal Highway Administration to determine adequate color and visual contrast of detectable warning surfaces (walking surfaces) for pedestrians who have visual impairments. Dr. Jenness participates in several professional organizations, including the Society of Automotive Engineers, the Transportation Research Board, the Human Factors and Ergonomics Society, and the Usability Professionals Association.

Customized driver feedback and traffic-safety culture

David W. Eby and C. Raymond Bingham

Social and Behavioral Analysis Division
University of Michigan Transportation Research Institute

Introduction

On September 11, 2001, also known as "9/11," 2,973 lives were lost in the United States (US) as the result of a terrorist attack on New York and Washington, DC (Wikipedia 2006). Of these fatalities, 2,602 occurred in the World Trade Center towers themselves. In the following five years many things changed. US citizens tolerated the expenditure of untold billions of dollars by the US government in efforts to prevent a reoccurrence of the 9/11 tragedy. As a direct result of this event, the US culture has noticeably shifted toward an antiterrorism perspective. As part of this shift in cultural perspective, US citizens routinely accept an increased level of screening and decreased level of privacy that they would not have tolerated prior to the September 11, 2001 attacks.

While most US residents have become acutely aware of the potential threat of another terrorist attack, they are seemingly blind to a significant threat to public safety that is ongoing and more costly in the loss of life than was 9/11; this threat is traffic crashes. On the same day as the 9/11 attacks, 205 people died in traffic crashes across the US (FARS 2006). In fact, during the week surrounding the attacks, 2,752 people died as a result of traffic crashes; more than the number of people killed in the World Trade Center towers. Indeed, for the entire 2001 calendar year, 42,196 people lost their lives as a result of injuries received in a traffic crash. This is equivalent to experiencing a 9/11 tragedy every 26 days.

Despite these disturbing statistics, 2001 was not a unique year for traffic fatalities, and the last five years have seen little progress in reducing US motor vehicle fatalities. Indeed, in 2005, the nation lost 43,443 people to traffic crashes. When yearly fatality figures for 2001 and 2005 are considered by driving exposure, 1.51 fatalities occurred per 100 million miles of vehicle travel (VMT) in 2001, which is not notably different from the rate of 1.47 observed in 2005 (FARS 2006). Given the lack of societal outrage over this tremendous, avoidable loss of life, one must assume that this level of traffic fatalities is acceptable to Americans. However, this assumption seems out-of-line with other manifestations of US cultural values for the defense and protection of the lives of US citizens that have been demonstrated in other circumstances, most notably in the response to the 9/11 attacks. The juxtaposition of the relatively low level of concern over motor vehicle crashes and the high level of concern and sacrifice in response to the 9/11 attacks demonstrates that the safety culture in the US is not uniform, but that the valuation of safety varies by circumstances, conditions, and source of the threat.

US safety culture as it relates to traffic safety (traffic-safety culture) was the focus of a recent panel workshop sponsored by the AAA Foundation for Traffic Safety (2006). This panel of traffic safety experts suggested that progress in reducing motor-vehicle–related fatalities in the US may be inhibited by the current traffic-safety culture and that in order to make significant reductions in traffic-crash–related deaths, the values inherent to the current traffic-safety culture

of the US would have to change. This paper focuses on the role that customized driver feedback might play in shifting the US traffic-safety culture toward increased concern and greater action to reduce motor vehicle fatalities. Several definitions are necessary to explore this issue.

First, for this paper the traffic-safety culture is defined as:

> *The totality of socially transmitted behavioral patterns, arts, beliefs, institutions, valuations, and all other products of human work and thought regarding traffic safety and the incidence of motor-vehicle–related crashes, injuries, and fatalities that guide social and individual behavior and are propagated through processes of individual learning.*

This definition is necessarily broad, reflecting the inherent complexity of any cultural value system and the wide array of factors that influence and define a culture. This definition stresses that culture is conveyed through an individual process that is relatively uniform across society; that is, the norms and tenets of a culture are learned by individuals in a society and then employed by those individuals, thereby perpetuating the manifestation of that culture. Finally, because it is a traffic-safety culture, its focus is inherently on the promotion and maintenance, or neglect and disintegration, of traffic safety at the societal level.

Second, we define customized driver feedback as:

> *Any objective and credible information a driver receives about his or her mental state or driving performance. This feedback can come to the driver directly (e.g., from an in-vehicle warning system), indirectly (e.g., through a passenger, parent, or supervisor), or globally through feedback from the larger social context (e.g., how others drive, traffic-safety messages).*

The remainder of this paper is divided into three parts. First, because cultural values and related behaviors are learned, we focus briefly on the various mechanisms by which humans learn, factors important to the process of learning, and the social factors that influence learning. Second, because current driver feedback systems use modern technology, we discuss technological issues related to the provision of customized driver feedback. Finally, the paper is concluded by a discussion of the manner in which customized driver feedback, as currently available using modern technological devices, might improve individual driver safety, and the likelihood that customized driver feedback might positively influence American traffic-safety culture currently and in the future.

Individual elements of cultural change

Elements of learning

Given that complex elements that collectively define culture are learned, the main reason for providing customized driver feedback at an individual level is to teach drivers behavioral patterns that are congruent with the values of a traffic-safety culture. Relating this to cultural change, the purpose of customized driver feedback is to shift individual behavior in the direction needed for the traffic-safety culture to value higher levels of safety and lower numbers of injuries

and deaths resulting from motor vehicle crashes. Thus, understanding how a person learns is important to understanding how customized driver feedback might promote a traffic-safety culture in which greater traffic safety is emphasized.

Learning processes

Following is a brief review of three learning processes that are relevant to traffic safety: classical; operant; and observational learning.

Classical learning, also know as classical conditioning, involves the simple association between a stimulus, such as the ringing of a bell, and a reflexive response, such as salivation as demonstrated by Pavlov (1927). However, there are many reflexive responses that might be triggered, including human emotions, such as fear, and there are many stimuli that can produce a reflexive response. Classical learning can use the stimulus response mechanism to teach a person to have either a reflexive response to a stimulus, or to change a natural response to one that is normally not present. For example, driving a car well over the speed limit might reflexively produce a fear response for a male teen driver, and in the absence of other stimuli, the response might naturally be to avoid high speeds and to maintain a speed closer to the limit. However, if exceeding the speed limit is paired with some other stimulus, a different response might be produced. For example, we know from research that teenage boys are more aggressive drivers in the presence of male peers (Simons-Morton, Lerner, and Singer 2005). This might result from the pairing of a stimulus, such as the presence of an influential male peer who is impressed by speeding, with a response such as the driver feeling more instrumental or more highly esteemed. Such a pairing might alter the driver's natural response to speed such that, over time, the driver learns through classical conditioning to enjoy speeding.

Three factors moderate the probability that classical learning will take place (Leahey and Harris 1997; Pavlov 1927; Ross and Ross 1971; Watson and Rayner 1920). The first factor is the frequency of the associative pairing of the stimulus and response. The more frequently that the male peer's being impressed by the driver's speeding is paired with the driver feeling positively about himself, the more likely it is that the driver will learn to enjoy speeding.

Second, as the interval between the stimulus and the initially unrelated emotional response is shortened, the probability that a behavior will be learned increases. Using the example of speeding, if the stimulus and response are paired immediately, as in the case that the peer is in the car when the driver is speeding, the probability that the driver will learn to enjoy speeding is more likely than in the situation where the driver speeds while driving alone and then later tells the peer about his speeding and experiences the response of feeling positively about himself.

Third, the probability of learning increases with the intensity of the reflexive response. Again referring to speeding, an example would be the presence of multiple peers in the car that are all impressed by the driver's speeding, resulting in a response that is greater than would be experienced if only a single peer were in the car. In this case, the driver is more likely to learn to enjoy speeding than if the response was less intense.

Although classical conditioning is a basic type of learning that deals largely with emotional or physiological responses, its influence on driving behaviors should not be discounted. Many driving behaviors might be learned through stimulus-response pairings that occur in situations where traffic safety is at issue. Recent research from the decision-making literature suggests that risk-based decision making may be strongly influenced by the emotions a person is experiencing

when they make the decision (see e.g., Slovic et al. 2002). If the risk-based decisions impact traffic safety, the emotion that influences it may be the result of classical learning, or may be altered through the same process.

Operant learning involves a person *engaging* in some behavior that is then paired with the experience of a specific outcome of that behavior (Skinner 1938; Thorndike 1898). If the outcome is positive, then the behavior is more likely to be repeated. In this case the outcome is known as a positive reinforcer. An outcome can also be reinforcing if it removes something that is unpleasant, and in this case it is known as a negative reinforcer. On the other hand, if the outcome is negative, it is known as punishment, and the behavior is less likely to be repeated. As with reinforcers, the removal of something pleasant can also be experienced as unpleasant, and in that case it is known as negative punishment. A traffic-safety example of operant learning is the pairing of starting a vehicle's engine (the behavior) and the sounding of the safety belt reminder (in this case the punishment) and relief from the reminder that drivers experience when they buckle their safety belts (a negative reinforcer).

Four factors influence whether a behavior is learned through operant learning (e.g., Kalish 1981; Holmes and Robbins 1987; Skinner 1961). First, the effectiveness of the reinforcement or punishment to change behavior decreases with the amount of time between the behavior and the outcome. If the safety belt reminder sounds immediately when the vehicle's engine is started while the driver is unbuckled, it is more likely that the driver will learn to use the safety belt than if the outcome came later, such as in the issuance of a citation (punishment).

Second, the effectiveness of the reinforcement or punishment to change behavior increases with the magnitude of the outcome. Using the safety belt example, drivers are more likely to learn to use their safety belts if the reminder is more annoying, troublesome, or interferes with their comfort (stronger punishment), or if the cessation of the reminder is rewarding (negative punishment).

Third, a behavior does not have to result in the outcome every time it happens in order for behavior to change. The key factor is that the person remembers that a certain outcome is likely to result from the behavior. For example, if the reminder does not sound every time the driver starts a vehicle's engine, such as when driving different vehicles that have the reminder disabled, drivers will still learn the behavior so long as they sometimes drive a vehicle with an activated reminder system.

Finally, the learned behaviors are not necessarily permanent. If the reinforcement or punishment is removed, the learned behavior may discontinue over time. If the driver were able to permanently disable the safety belt reminder, the driver would eventually stop using a safety belt (assuming there were no other reinforcers or punishers to sustain the behavior). Hence, it is important that reminder systems be reliable and not easily disabled.

Observational learning involves people learning by observing what others do and the resulting consequences that others experience because of their behavior. Some have argued that an individual's culture strongly influences behavior in this way (McGraw-Hill 2005): that people learn by observing behaviors, consequences, emotional responses, and so forth, from the cultural setting that surrounds them. For example, a driver might learn to consistently exceed the speed

limit by 10 mph and experience little risk of being issued a citation by observing that other drivers typically exceed the speed limit by this amount without being stopped by law enforcement.

As with the other learning processes, there are several factors that influence observational learning (Bandura 1977, 1986, 1989). First, a person must be paying reasonably close attention to the person or persons performing the behavior. Second, a person must remember the action and consequences at a later time. Third, a person must be able to reproduce the behavior. Fourth, a person must have some motivation for performing the behavior. Using the example of traveling 10 mph over the speed limit, if drivers are unaware of the specifics of other drivers' speeding behavior, such as the exceedance of the speed limit that is permissible, if they fail to remember the specifics of the behavior at a later time, or if their vehicle will not exceed the speed limit by that amount, or if they have no reason to drive faster, they will not learn to typically exceed the speed limit by 10 mph.

Motivation

Motivation is an important part of learning and of using learned behaviors. It has been defined as the set of influences that account for the initiation, direction, intensity, and persistence of behavior (Bernstein et al. 1991). In other words, motivation is the reason why people do what they do. An understanding of motivation is important for those who wish to change American traffic-safety culture because people must have a motivation to change their behavior. The set of potential motivations is quite varied and complex, ranging from hunger, to the need for achievement, to the need for excitement (e.g., Maslow 1971). An important part of changing the American traffic-safety culture will be identifying the motivations that are most compelling to American citizens, so that their desire to act in a manner consistent with a safety culture is heightened, and their willingness to learn is enhanced.

Sociocultural elements of cultural change

Motor vehicle transportation has a large social component: people frequently drive to serve social needs, drivers interact in a social environment while in traffic or with passengers in the car, and people's thoughts and beliefs about social interactions influence how they drive. Thus, social factors are an important facet of traffic-safety culture. Here we discuss some of the more common social factors that may have important influences on the traffic-safety culture and that may be shaped through customized driver feedback.

Social norms: Culture is governed by a subtle set of rules that define appropriate and inappropriate behaviors, attitudes, and beliefs (Bernstein et al. 1991). The same is true for American traffic-safety culture. These rules, or social norms, may be explicit, but are quite often implicit (such as the number of cars that can travel through an intersection once the light has turned red). Social norms are learned through interaction with society. Because many people have a strong desire to conform and belong to a group, social norms can have a powerful influence over behaviors. People who unknowingly break a social norm often receive clear negative feedback from others in the form of censure, exclusion, or disapproval. Social norms do not necessarily follow written law, nor are they universal or concrete.

People's perceptions of social norms are not always correct. Correcting people's perceptions of social norms has been used successfully to change people's behavior. For example, many people overestimate the amount of alcohol that others drink, or that others think is appropriate to drink. When these norms are corrected, people often respond by moderating their own alcohol consumption. A similar approach could be used to promote a culture that values traffic safety, by providing people with accurate information about driving behavior and others' expectations. Customized driver feedback could have a great influence of traffic-safety culture if this feedback was successful in changing social norms toward safer driving behaviors, and one way this might occur is by providing accurate information on driving norms to drivers.

Attribution: People continually try to make sense of their social world, including attributing causes to the events they observe (Zimbardo 1985). For example, if a driver were to observe a vehicle drifting over the centerline of a roadway, that driver may assign the cause to the other driver being intoxicated or distracted. Research on attribution has identified several factors that affect how people make attributions (e.g., Augoustinos and Walker 1995; Jaspars, Hewstone, and Fincham 1983). First, people act as naïve scientists when making attributions, deducing causes using common sense. They, therefore, make naïve mistakes, such as assigning a single cause, rather than multiple causes, for an event. Second, people will consider two events as related causally if they occur close together in time. Finally, people tend to make attributions of other people's behavior as being caused by internal factors rather than external factors. Thus, a person is more likely to blame an elderly driver's poorly executed left turn to the driver's declining abilities rather than to he or she being temporarily distracted.

Customized driver-feedback technology

Customized driver feedback could take one of two general forms using current technology. The first is feedback issued to the driver through an adaptive feedback program that is integrated into the vehicle. The second is a system that issues feedback from information that is retrieved form the vehicle's systems, routed to an external agent where it is organized and assimilated for graphic and tabular presentation, and then relayed to the driver through a secondary process, such as through a fleet supervisor, vehicle rental agency, or a parent.

Integrated customized driver-feedback systems

Advances in computer technology have introduced the potential to monitor many elements of vehicle functioning and factors in the area surrounding the vehicle, and to transmit this information instantly to the driver of the vehicle. For example, using the On-Board Diagnostics (OBD) II protocols in the on-board computing systems of modern vehicles, information on the function of many aspects of the engine and vehicular systems can be obtained, including information on engine RPM, throttle position, steering wheel position, brake pedal motion, belt use, engine load, fuel pressure, fuel system status, short- and long-term-fuel trim, battery voltage, timing advance, coolant temperature, airflow rate, intake air temperature, intake manifold pressure, oxygen-sensor voltage, as well as other functions. While much of this information is not pertinent to helping the driver learn safe driving practices and changing the traffic-safety culture, other sources of information are relevant.

Additional sensor systems come standard on motor vehicles that are designed to provide drivers with feedback relating to safety systems. One of these is the safety belt reminder. While these reminders have not yet been programmed to be interactive, they have the ability to be programmed to be interactive so that more invasive reminders are issued if the safety belt is not being used (e.g., increasing reminder intensity the further the car is driven without the safety belt being engaged, or feedback that adapts to the driver of the vehicle over time, with less intense reminders provided for drivers who consistently use their belts, and more intense reminders to drivers who do not).

Other additional sensors that are becoming available or may soon be available include headway sensors that can provide warning if the vehicle is approaching another vehicle too quickly or is following a lead vehicle too closely. Proximity warnings are another example of technological devices that can potentially increase driver safety by providing drivers with feedback on the location of other vehicles that are traveling nearby. These devices could be made to adapt to the roadway type or to the characteristics of the driver.

Smart cards are another technological device that could soon play a role in adaptive driver feedback by allowing the driver to be identified by the vehicle's onboard computer. Information provided by a smart card can be combined with data collected by the onboard computer to coordinate the various onboard safety and warning systems available in a particular vehicle and to tailor them to the characteristics of a given driver. This information could then be used by the onboard systems to select and provide feedback that is appropriate for the driver of the vehicle. For example, if the driver is identified as a teen driver, the threshold of headway warnings might be lowered so that a warning is given at a greater following distance than would be needed for an experienced driver. Another example is the selection of the safety belt warning procedure that is appropriate for a driver who is often reluctant to buckle up.

External customized driver-feedback systems

Advances in telecommunication, global positioning, onboard computing, and sensor technologies have led to the development of an assortment of systems that are capable of monitoring driver state and driving performance, and providing feedback to the driver through the driver's overseer (e.g., parent or fleet manager). While the majority of these systems have been designed for use with commercial motor vehicle (CMV) drivers, many have been adapted for use in private vehicles, and others have been designed with specific types of drivers in mind, such as young novice drivers or elderly drivers. Because of the large number of external customized feedback systems available, a complete review will not be attempted here. (For a more extensive review of available external customized driver feedback systems, see Finnegan and Sirota 2004 and Huang et al. 2005). However, common types of information provided by external customized driver feedback systems include any of the functions monitored by the OBD II protocol, following distance, speed, location, time that the vehicle is in motion, stop locations and duration, hard stops/starts, turning, audio of the interior of the vehicle, and/or video feedback of both the driver/passenger compartment and external surroundings of the vehicle. As with direct driver feedback systems, these systems could be designed to adapt to individual drivers, and with the addition of a key fob or smart card, could identify the driver and apply personalized feedback protocols.

Issues for effective customized driver feedback

For both the direct and external systems, four questions can be asked: (1) What behaviors are monitored? (2) How is the information acquired and analyzed? (3) How is the information formatted and delivered? and (4) How is the feedback going to be learned by the driver and influence the greater traffic-safety culture.

Monitoring driving behaviors

Driving is a complex activity requiring the coordinated proper performance of a variety of skills. Which of these skills are critical for safe driving? An expert panel for a recent study on the effects of health concerns of driving performance addressed this question (Eby, Molnar, and Blatt 2005). The results of this expert panel (Eby et al. 2005) were used to develop a set of "critical driving skills" and divide them into the following three categories of skills: strategic, tactical, and operational.

Strategic skills relate to pretrip activities and preparation for driving. These activities vary depending on the purpose, type and length of the trip, the area that will be traversed during the trip, and the trip's destination. Strategic skills include general planning, selecting routes, coordinating travel demands with alcohol/drug use, care of one's own physical and emotional condition, safety belt and other safety restraint needs and use, start and stop times and restrictions on driving, and navigation/wayfinding.

Tactical skills relate to the management of driving demands and tasks that are limited in their duration, and all relate directly to vehicle handling and the execution of driving maneuvers. Tactical skills identified by the panel included, yielding right of way, intersection negotiation, left turns, right turns, maintaining proper speed, responding appropriately to traffic signs and signals, backing up, changing lanes, passing, maintaining lane position, following/gap acceptance/ judging distances, maintaining attention, observing surroundings, negotiating curves, signaling, and merging. These tactical skills vary in difficulty and, therefore, in the skill level required for safe execution. In addition, the levels of difficulty of these tasks vary by age and driving experience, with novice, younger, and older drivers experiencing greater demands and difficulty in performing these skills.

Operational skills are relevant to the immediate control of the vehicle, and are required over longer stretches of time. These include such basic skills as steering, accelerating, braking or stopping, speed control, signal use (indicators), and the use of headlights.

Collectively, these skills can be thought of as "driver behavior," and a driver's capabilities in performing these skills can be thought of as "driver performance." As these skills are degraded, crash risk increases. As they improve, crash risk decreases. Again, devices that monitor the driver behaviors and vehicle responses related to these skills could be designed to adapt to the driver, over time, by collecting information on the driver, as well as by linking the monitoring system to a smart card or other source of information that the system could use to identify the driver and apply the feedback protocol that is appropriate for that driver.

Information analysis, format, and delivery

As previously noted, critical driving skills can be monitored and information for feedback can be acquired through the use of a variety of technological mechanisms. In a few cases, data from these sensors can be used directly as feedback to the driver indicating the performance of a critical driving skill. One example is a simple safety belt monitor and feedback device. However, in the overwhelming majority of cases, the information taken directly from a given sensor or monitoring device must be analyzed, extraneous information removed, relevant information formatted, and the information delivered in an understandable manner to convey useful information to the driver regarding performance of critical driving skills and the resulting level of safety.

Gathering and processing data is a very complex task, even where simple driving tasks are concerned. For example, to obtain a measure of vehicle-following distance on a trip, return signals from forward-facing radars and information about the vehicle speed and acceleration need to be combined algorithmically over the trip to determine a function that indicates the proportion of time the driver is following too closely (see, e.g., Fancher and Bareket 1998). Because of natural surrounding-vehicle lane-changes and lead-vehicle breaking events, all drivers are too close to lead-vehicles for some proportion of a trip, even if they are driving safely. Where is the cutoff for safe versus unsafe following? A similar question can be asked for most of the critical driving skills and empirical answers are needed if customized driver feedback technology is going to positively influence traffic-safety culture.

Because of the complexity of information provided by monitoring systems, the analysis of incoming information is the first critical task. Analysis of these data is a daunting task for several reasons. First, most of the information from monitors and vehicle systems is not directly usable as feedback to the driver. Before feedback information can be identified, irrelevant information must be removed without eliminating information that is relevant to safety. Second, the information needed to provide driver feedback on even simple tasks, such as lane keeping, must be compiled from various sources and then combined in a manner that allows accurate coherent feedback information. The difficulty of this task is only amplified in the case of more complex driving behaviors, such as changing lanes on a busy freeway or making a left hand turn. Finally, safe driving is made up of many driver behaviors. The process of extracting feedback information from monitors and systems for each of these behaviors must happen first and must then be followed by assigning the information a priority score for delivery so that the driver is not overwhelmed by a large amount of feedback.

Once the analysis is complete, the feedback must be formatted so that it is easy for the driver to interpret and use. Hence, the information collected and combined from various systems and monitors must be reduced to a simple, intelligible, and easily utilizable message that can be given to the driver. Finally, the feedback must be delivered to the driver in a manner that does not decrease safety by distracting the driver or overburdening the driver with tasks required by various sources.

Running throughout the analysis, formatting, and delivery of the information is the need to adapt the feedback so that it is appropriate for a given driver who may be old or young, experienced or novice, and highly skilled or unskilled.

Driver learning and the traffic-safety culture

Assuming that critical driving skills can be accurately detected and monitored, this information needs to be transmitted to the driver in a way that will result in the driver learning to behave in a manner that enhances traffic safety. As pointed out in the initial section of this paper, the content and format of the feedback to the driver is critical in order for the driver to learn safe driving behavior. Feedback should employ the principles of learning (e.g., stimulus-response, reward and punishment), recognize the role of motivation in behavior change, utilize social factors to influence behavior change, and be informed by the factors and conditions that enhance the learning process. Very good guidelines for effective customized driver feedback have been developed by Huang et al. (2005) and are paraphrased and expanded upon here:

- The feedback must be perceived to be objective, accurate, and from a credible source.
- Terms must be used that describe specific, observable behaviors.
- Personality traits should not be targeted, as these cannot be easily changed.
- Only behaviors that the driver can change should be targeted.
- Clearly the criteria for safe driving should be provided and not just the identification of unsafe driving performance.
- Feedback should not be judgmental.
- Feedback should increase the motivation for behavior change.
- Performance feedback should be given as closely as possible to when the behavior occurs.
- Feedback that promotes emotional reactions should be avoided.
- Social norms governing behavior for a driver's particular group should be utilized in the feedback.
- Feedback should be specific for the audience (i.e., driver, parent, boss, etc.).

Can customized driver feedback devices positively influence traffic-safety culture?

It is important to draw upon all available resources in an effort to promote a traffic-safety culture that values and promotes safe driving practices and refuses to accept driving behavior that places others at risk. As previously mentioned, one potential resource is customized driver feedback and the technology that will make it possible. This said, as we look for technological approaches to enhance traffic safety, we must remain cognizant of several caveats.

First, while living in an era of rapid technological advance, the technology and software needed to interactively gather information, interpret it and reduce it to understandable feedback for the driver, and then adapt it to the specific driving habits of individual drivers has not yet been combined in a form that will provide a comprehensive assessment of driver performance. However, advances are continually moving us toward a time when systems will be available and linked in the manner needed to provide comprehensive customized driver feedback.

With the technology and external monitoring devices that are now available, the ability to discern good from bad driving behavior is, at best, difficult and limited. Many systems provide information that is too limited to be useful. For example, information on acceleration is available directly from the OBD II protocol; however, the information necessary to determine whether the observed rapid acceleration was a result of risk-taking, reckless driving, or proper evasive action taken to avoid a crash is not available. As another example, monitoring older drivers with a progressive disease could be useful for enhancing and extending their safe mobility. Older drivers experiencing early-stage dementia from Alzheimer's Disease could continue to drive longer if a device were available that would monitor their driving behavior for signs that the driver has become lost or confused, and yet this seemingly simple determination is difficult to program into a machine. For example, how would technology distinguish between a driver who is confused and one who is doubling back to run a forgotten errand, or is searching for an address in an unfamiliar neighborhood? Such small distinctions are difficult, and the simple installation of currently available aftermarket devices cannot address such a specialized issue. In sum, correct interpretation of driving behavior is one impediment to the development of effective customized driver feedback systems and should be the topic of further research.

Another issue that will need to be addressed as customized driver feedback systems are developed is that drivers may be overly reliant on the system, using it as a safety net rather than as a tool to enhance their safety. Some current technology has resulted in unanticipated outcomes that have negatively affected traffic safety. One example is antilock brakes, which were intended to increase traffic safety through the optimization of both vehicle control and stopping distance by disallowing the brakes to become locked. Instead of this intended outcome, it appeared that many people misunderstood the function of the antilock system or adversely changed their behavior as a reaction to the system, resulting in an overall increase in crash rates. There is a similar risk for any new device that is introduced. A misunderstanding of the purpose of the technology, or unrealistic confidence in the technology may increase risk. For example, drivers whose vehicles are equipped with a headway warning system may trust the system to keep them safe, and be less attentive to traffic ahead of them. These concerns relate back to the need for the feedback to be delivered in a manner that helps the driver learn safe driving habits, rather than removing or taking over driving functions.

Finally, it is obvious that the manner in which customized driver feedback will change the traffic-safety culture of the US will be by altering the behavior and attitudes of individual drivers. Hence, if customized driver feedback is to move the traffic-safety culture in the direction of greater traffic safety, it must possess a relatively high degree of uniformity in the safe driving behaviors that are promoted and in the way drivers learn these behaviors from the system. This uniformity must extend across vehicle manufacturers but also must apply equally well from one state to another. If there is too great of a disparity across vehicle makes and types in the learning process that the feedback system promotes, or if there is too little uniformity in laws and regulations promoting safe driving behavior across states, customized feedback will be less effective in shifting the traffic-safety culture in the desired direction because people will be learning behaviors and adopting attitudes that are discrepant and potentially incompatible. The result could range from increased confusion on the road as drivers try to drive according to disparate rules, to an increase in crash rates if differences in the systems are directly contradictory.

Conclusion

This brief examination of various issues related to customized driver feedback as a mechanism to promote change in the US traffic-safety culture toward greater valuation of traffic safety is far from comprehensive. Nevertheless, this paper raises several key points for consideration. The first is that the means by which customized driver feedback would impact the traffic-safety culture is through individual drivers (although many drivers will need to be receiving feedback for the culture to be influenced). The clear mechanism by which such change would occur is through learning; in order to change driver behavior and attitudes, drivers must learn new driving skills, behaviors and attitudes that promote safety. This is a key issue as the use of customized driver feedback is concerned because it suggests that feedback should not eliminate driver responsibility for safe driving practices, such as maintaining safe headway, but should instead leave this responsibility in the hands of the driver while providing feedback that increases the likelihood that the driver will learn safer driving behaviors and attitudes.

Second, this paper directed attention toward a critical impediment to devising feedback systems that promote the learning of safe driving behaviors and attitudes. Quite simply, this impediment is that while much of the sensor technology and software needed is available, it is limited and frequently not available in a form that lends itself directly to the development of comprehensive customized driver feedback systems. The first step needed is to devise a means by which the independent systems that generate customized driver feedback can be interconnected so that the can be efficiently consolidated. The next task will be to develop an analysis system that can sort through the large amount of data provided by the various systems and extract the information that is essential for providing feedback. Systems will also need to be developed that can take the raw information from the analysis and transform it into a coherent and deliverable message, organize it into a hierarchy with those that are most essential to safety being at the top, and monitor the activities of the drivers to determine their current workload and identify appropriate times to deliver the feedback. Finally, research examining modes of message delivery will need to identify the most appropriate mode of delivery so that the message is simultaneously easily understood, not distracting, and reliably conveys information that the driver interprets correctly.

This paper also touched on the difficulty of interpreting the information obtained from onboard systems. This will be another major hurdle in designing a system that promotes the learning of safe driving behavior. It will be essential that driving behaviors are followed by appropriate responses and reinforcers, or the intended behavior will not be learned. By simply providing feedback about the rate of acceleration, without knowing if it was done to increase safety or in a manner that decreases safety, will not have the intended result. Research should examine the effectiveness and feasibility of various rewards and punishments that can be utilized to facilitate driving. One current system, Progressive Insurance's TripSensor™, awards what this system defines as safe driving through discounts on insurance premiums. It is unknown if this is type of reward changes behavior.

The day when drivers can be completely reliant on technology to help them drive safely is probably a long way off, and in fact, may never arrive. This means that we must focus efforts on the development and design of customized feedback systems that will increase traffic safety. This must be done planfully and with care to ensure that the systems have the intended effect on driving behavior and safety; that the systems are not just crutches to assist the driver, but that they effectively promote learning of safe driving behaviors and attitudes.

References

AAA Foundation for Traffic Safety (AAAFTS). 2006. *Traffic safety issues of the future: A long range research agenda*. Washington, DC.

Augoustinos, M., and I. Walker. 1995. *Social cognition: An integrated approach*. Thousand Oaks, CA: Sage Publications, Inc.

Bandura, A. 1977. *Social learning theory.* Englewood Cliffs, NJ: Prentice Hall.

———. 1986. *Social foundations of thought and action.* Englewood Cliffs, NJ: Prentice Hall.

———. 1989. Social cognitive theory. In R. Vasta, ed. *Six theories of child development: Revised formulations and current issues*. Greenwich, CT: JAI Press.

Bernstein, D. A., E. J. Roy, T. K. Scrull, and C. D. Wickens. 1991. *Psychology, 2nd Edition*. Boston, MA: Houghton Mifflin Company.

Eby, D. W., L. Molnar, and J. Blatt. 2005. Common health concerns and symptoms associated with aging: A basis for self-screening by older drivers. *The Gerontologist*, Special Issue 45:466.

Fancher, P. S., and Z. Bareket. 1998. Evolving model for studying driver-vehicle system performance in longitudinal control of headway. *Transportation Research Record* 1631:13–19.

Fatality Analysis Reporting System (FARS). 2006. *Fatality analysis reporting system*. Washington, DC: US Department of Transportation. http://www-fars.nhtsa.dot.gov/.

Finnegan, D., and C. Sirota. 2004. *Is vehicle data recording auto insurance's future?* Jersey City, NJ: Quality Planning Corporation and ISO Properties, Inc.

Holmes, S. J., and L. N. Robbins. 1987. The influence of childhood disciplinary experience on the development of alcoholism and depression. *Journal of Child Psychology and Psychiatry and Applied Disciplines* 28:399–415.

Huang, Y., M. Roetting, J. R. McDevitt, D. Melton, T. K. Courtney. 2005. In-vehicle safety feedback. *Professional Safety*, January, 20–27.

Jaspars, J., M. Hewstone, and F. D. Fincham. 1983. Attribution theory and research: The state of the art. In J. Jaspars, F. D. Fincham, M. Hewstone, eds. *Attribution theory and research: Conceptual, developmental and social dimensions*. New York, NY: Academic Press.

Kalish, H. I. 1981. *From behavioral science to behavior modification*. New York, NY: McGraw Hill.

Leahey, T. H., and R. J. Harris. 1997. *Learning and cognition,* 4th Edition. Upper Saddle River, NJ: Prentice-Hall, Inc.

Maslow, A. H. 1971. *The farther reaches of human nature*. New York, NY: Viking.

McGraw-Hill 2005. *Encyclopedia of science and technology.* The McGraw-Hill Companies, Inc.

Pavlov, I. P. 1927. *Conditioned reflexes*. New York, NY: Dover.

Ross, S. M., and L. E. Ross. 1971. Comparison of trace and delay classical eyelid conditioning as a function of interstimulus interval. *Journal of Experimental Psychology* 91:165–7.

Simons-Morton, B., N. Lerner, and J. Singer. 2005. The observed effects of teenage passengers on the risky driving behavior of teenage drivers. *Accident Analysis and Prevention* 37:973–82.

Skinner, B. F. 1938. *The behavior of organisms*. New York, NY: Appelton-Century-Crofts.

———. 1961. *Cumulative record*, 3rd Edition. Englewood Cliffs, NJ: Prentice-Hall.

Slovic, P., M. Finucane, E. Peters, and D. G. MacGregor. 2002. The affect heuristic. In T. Gilovich, D. Griffin, and D. Kahneman, eds. *Heuristics and biases: The psychology of intuitive judgment*. 397–420. Cambridge, MA: Cambridge University Press.

Thorndike, E. L. 1898. Animal intelligence: An experimental study of the associative processes in animals. *Psychological Monographs* 2 (Whole No. 8).

Watson, J., and R. Rayner. 1920. Conditioned emotional responses. *Journal of Experimental Psychology* 3:1–14.

Wikipedia. 2006. *September 11, 2001 Attacks*. Wikipedia Foundation Inc. URL: http://en.wikipedia.org/wiki/September_11,_2001_attacks.

Zimbardo, P. G. 1985. *Psychology and life*. Harper Collins Publishers.

Biographical statements

Dr. David W. Eby is a Research Associate Professor and Head of the Social and Behavioral Analysis Division at the University of Michigan Transportation Research Institute (UMTRI). Dr. Eby holds a doctorate degree in experimental psychology from the University of California, Santa Barbara. He has also held a postdoctoral fellowship in the Department of Cognitive Sciences at the University of California, Irvine. The primary focus of his research is to reduce the number of deaths and injuries associated with motor-vehicle crashes by conducting behavioral studies that improves the safety of automobile transportation. Dr. Eby's topics of research include studies related to young driver cognitive development; improving older driver decision making, use and misuse of occupant restraints; and the use of in-vehicle technology to enhance safety and mobility. He has authored more than 140 scientific articles, technical reports, and book chapters. Dr. Eby is an Associate Editor of Accident Analysis & Prevention and a co-Convener of the transportation and aging interest group of the Gerontological Society of America.

Dr. C. Raymond Bingham is a research associate professor in UMTRI's Social and Behavioral Analysis Division and in the Department of Psychiatry of the University of Michigan School of Medicine. He received his doctorate in human development from the Pennsylvania State University in 1993. Dr. Bingham's areas of expertise include: longitudinal research design, methods, and data analysis and adolescent and young adult psychosocial development and problem behavior. Dr. Bingham's research focuses on adolescent and young adult driving behavior, alcohol use, adolescent drink/driving, college drinking and drink/driving, and interventions to reduce alcohol use and drink/driving among teens and young adults. Dr. Bingham has been Principal or Co-Investigator on over 20 grants and contracts funded by federal, state, and local agencies, and private corporations. He has authored over 150 scientific articles, reports, presentations and book chapters, is on the editorial board of three scientific journals and serves as an ad hoc reviewer for 17 others.

The culture of traffic safety in rural America

Nicholas J. Ward
University of Minnesota

Overview

Whereas most traffic crashes occur in urban areas, the rates of *fatal crashes and traffic fatalities* (per capita and per vehicle mile) are higher in rural areas. The distinction between rural and urban areas is, therefore, an important delineation in any policy discussion about traffic safety. In particular, efforts to distinguish between rural and urban traffic safety should focus on those factors that increase the risk of fatal outcomes in rural areas. Notably, several aspects of the rural road environment can be characterized as hazardous. For example, several road design elements of rural roads, such as high speed limits, narrow shoulders with ditches, and the absence of median barriers can increase the risk of fatal crash types, such as head-on and rollover crashes. Moreover, the low population density and geographic isolation of rural communities can increase detection, response, and travel time for emergency medical services, thereby reducing crash survivability. In addition, the *human factors* associated with common impairment states and driving behaviors amongst rural drivers are also significant contributors to rural fatal crashes. The social forces that enable these human factors are embodied in the culture of rural communities. Indeed, comparisons of traffic safety performance between different countries have highlighted the importance of social attitudes, safety behaviors, and traffic safety policy in reducing fatal traffic crashes (Page 2001). Thus, it is necessary to consider the human factors associated with fatal rural crashes together with the relevant *socio-cultural context* of rural communities. Only by understanding the psychological and social factors that define the rural safety culture may it then be possible to develop human-centered and culturally sensitive programs to improve traffic safety in rural America.

Introduction

The World Health Organization (WHO) estimates that 1.2 million people each year are fatally-injured worldwide in traffic crashes with a global cost of $518 billion (Peden et al. 2004). Indeed, the WHO has projected that road traffic injuries will be the third leading cause of death and disability worldwide by the year 2020 (Peden et al. 2004). Similarly, the National Safety Council has reported that traffic crashes are the most common source of fatality resulting from unintentional injury for all age groups up to 75 years (NSC 2002).

In this context, traffic safety is a major public health issue for all motorized regions of the world. In particular, those areas defned as “rural” within a country tend to have the fatality rate (Brown, Khanna, and Hunt 2000) as well as lower economic indicators and lower population densities compared to urban areas (USDA 2006; Clark 2003).

Whereas differences in safety attitudes and reported behaviors between cultures of different countries have been considered (Lajunen, Parker, and Summala 2004), less attention has been given to contemporary definitions of rural and urban "culture" within a country that are conceptually relevant to traffic safety and able to elucidate the relationship between cultural beliefs, driving behavior, and associated crash risk. Admittedly, given the diversity of rural and urban areas, it is difficult to frame a reliable and valid definition of culture without regressing to overgeneralizations and stereotypes. None-the-less, the importance of understanding the contribution of belief structures engendered in a culture is paramount to understanding, predicting, and modifying the safety attitudes, driving behaviors, and traffic safety policies that are guided by cultural beliefs (Rothe and Elgert 2003). Indeed, traffic safety policy directed at the issue of rural fatal crashes must encompass and reflect the defining characteristics of rural culture in order to be both effective and accepted within rural communities. Toward that end, we need to develop an appropriate conceptual framework to define culture and apply this to a model that relates cultural variables to safety outcomes in order to support the rationale and contextually embedded development of traffic safety policies for rural America.

This chapter will compare traffic safety between rural and urban areas within the USA. The purpose of this analysis is to identify the nature of the fatal crashes and identify those factors that can be attributed to the higher fatality rate in rural areas. Specifically, this chapter will attempt to focus on the notion of a "rural traffic safety culture" that fosters attitudes and driving behaviors that increase the risk of fatal crashes in rural communities.

Defining "rural"

Logically, the central thesis of this chapter is dependent on the meaning of "rural". The meaning can be considered both as a classification applied to locations (rural) and as a continuum characterizing individuals (rurality) (Deavers 1992). As summarized in Table 1, there are several attributes that can be used to positively classify rural locations or describe the rurality of population cultures (Bealer, Willits, and Kuvlesky 1965; Deaver 1992; Miller and Lullof 1981; Roth and Elgert 2003; Weisheit, Falcone, and Wells 2006; Wilkinson 1991).1 In the United States, rural regions account for 75% of the land mass (Coben 2006) with 17% of the population is classified as rural (Coben 2006).

From this summary, it is apparent that a precise definition of rural is illusive because this term can be based on different attributes and applied to either locations or populations.2 However, the single most common definition is *demographic*, although the criterion can be arbitrary and not represent the essence of rurality (Bealer et al. 1965; Miller and Luloff 1981; Willkinson 1991; Weisheit et al. 2006). There is also considerable diversity *between* areas defined as rural as well as changes over time *within* rural areas (Deavers 1992; Weisheit et al. 2006). As a result, "an

[1] Rural definitions are considered "positive" by prescribing specific attributes (e.g., a county with no city greater than 5000 people) or "negative" by inferring attributes that are not defined as urban (e.g., areas not defined as metropolitan). Positive definitions are preferred because they have meaningful content (i.e., they describe specific attributes rather then simply representing excluded areas), are sensitive to rural diversity, and are independent of definitions of urban (Weishet et al. 2006).

[2] There is also some contradiction in the use of population attributes both as an independent variable (defining rural and urban) and as a dependent variable (describing the nature of populations defined as rural based on other defining attributes) (Bealer et al. 1965; see also Footnote 6 of Miller and Luloff 1981).

accurate and useful definition of what is rural needs to accommodate the diversity of current conditions and development prospects among rural areas" (Deavers 1992, p. 189). However, despite this ambiguity "there is something to the idea of 'rural' that distinguishes it in intuitively and sociologically important ways from what is called 'urban'" (Weisheit et al. 2006, p. 193).3

Table 1. Common attributes for definitions of "rural" and "urban" areas.

Dimension	Rural	Urban	Comments
Demographic (attributions to locations)	Low population size and density; geographic isolation; outside boundary of urban area or urban cluster.	Urbanized area or urban cluster.4	There are some explicit definitions that stipulate a threshold for rural places in terms of population or density. However, these thresholds are not universally applied.
Economic (attributions to locations and populations)	Low economic indicators; economic simplicity (single industry, restricted labor diversity, limited functional differentiation); no longer predominately farming and agriculture.	High economic indicators; economic complexity (multiple industries, diverse labor, and differentiation of functionality).	Equating rural with farming and agriculture is no longer valid in modern society.[5]
Social structure (attributions to populations)	Intimate, informal, and homogeneous forms of social interaction; small but dense social linkages6; social order maintained by social bonds; limited social resources (e.g., hospitals).	Distant, formal, and heterogeneous forms of social interaction; small and less dense social linkages; social order maintained by formality and laws; plentiful social resources (e.g., public transportation).	
Cultural (attributions to populations)	Reluctance to share local problems; distrust of government; traditional, conservative, provincial, slow to change; fatalistic, deterministic.	Modern, liberal, responsive to change.	The rural culture classification can be viewed as a personal attribute (rurality) that is independent of current location and occupation.[7]

[3] For this reason, Weisheit et al. (2006) concede that rural may best be described as a "sensitizing concept" that does not possess definitive attributes or prescribe specific interpretations, but rather provides a general reference to guide the direction of scientific inquiries and perspectives of what is relevant (see Blumer 1953).

[4] The Census Bureau (Census 2006) defines an "urbanized area" as a "large central area and adjacent densely settled census blocks" with a total population of at least 50,000. Similarly, "urban clusters" have populations of at least 2,500 people.

[5] For example, manufacturing is a larger source of employment in rural areas with less than 10% of the rural labor force involved in farming (Weisheit et al. 2006).

[6] Intimate and distant refer to the physical proximity between acquaintanceships. Density in this context refers to the extent of inter-relationship between people acquainted with each other in a community (Weisheit et al. 2006). A small population in which everyone is related or knows each other can be described as a small network with a high "density of acquaintanceship." Conversely, a few people related to each other in a larger population can be described as a small network with a low density of acquaintanceship.

[7] For example, Miller and Luloff (1981) distinguished between rural and urban cultural classifications based on a composite measure of attitudes and beliefs for three cultural issues: civil liberties, abortion, and racial segregation.

Rural traffic safety

Traffic safety in rural areas is both quantitatively and qualitatively different from urban areas in terms of the risk of a crash, type of crash, and contributing factors associated with the crash (NHTSA 1996).

Crash risk

Crash risk is expressed as a function of exposure relative to population of travel. In terms of crashes per capita, despite the fact that only 17% of the US population is classified as rural (Coben 2006), 58% of all fatal crashes and 60% of traffic fatalities were recorded in rural regions of the US between 1993 and 2004 (Burgess 2005). Thus, fatal crashes and traffic fatalities in rural areas are 3.5 times more prevalent than expected on the basis of the percentage of the total population that is classified as rural.8 Indeed, Brown et al. (2000) estimated that the rate of fatalities *per 100,000 population* was more than 4 times higher for rural crashes (42.71 ± 4.3) than for urban crashes (10.43 ± 1.51) over a twenty-year period. In term of crashes per mile traveled, the rate of fatal crashes *per 100 million vehicle miles traveled* (MVMT) during rural travel was nearly double the rate for urban travel between 1993 and 2004 even though less than half (39%) of the total vehicle miles traveled are on rural roads (Burgess 2005).

These data demonstrate that rural areas consistently have a higher risk of *fatal crashes and traffic fatalities* in all years and for most US states (Brown et al. 2000; Burgess 2005; NHTSA 2004). Admittedly, because of the large number of *non-fatal crashes* in urban areas (IIHS 2006), the total incidence for all crashes may be higher in urban areas (Zwerling et al. 2005, Table 2). Thus, the critical question is not why rural areas have more crashes, but why rural crashes are predisposed to be fatal (Zwerling et al. 2005). Accordingly, it is necessary to examine the types of rural crash that are fatal and identify the factors that increase the fatality risk in rural crashes.

Crash type

Table 2 lists the distinctive characteristics of rural fatal crashes; that is, research has demonstrated that these characteristics significantly differentiate between rural and urban fatal crashes (Burgess 2005; GAO 2004; NHTSA 1996, 2004; Coben 2006; Muelleman and Mueller 1996; TRIP 2005; Zwerling et al. 2005). This characterization suggests that rural crashes typically include high-risk driver groups with vehicle maneuvers that can lead to high-impact crash types resulting in severe vehicle damage and occupant injury. This propensity for fatal crash types in

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People were classified as a "conservative" rural type if they were in the lower quartile for all three factors. Conversely, people were classified as a "liberal" urban type if they were in the upper quartile for all three factors. These cultural classifications were then compared to a rural and urban demographic definitions using size of place of current residence. This analysis indicated that (1) a "pure" cultural type (consistently being in the defining quartile across all three factors) existed only for a small sample (12%); and (2) current residency did not match the cultural classification. For example, 9% of rural residents had an urban cultural type and 83% of urban residents had a rural culture type.

[8] This assertion assumes that all drivers and occupants of vehicles involved in rural crashes are themselves rural residents. Indeed, data provided by Blatt and Furman (1998) indicate that most rural fatal crashes involve rural residents (and that most rural residents involved in fatal crashes were traveling on rural roads).

rural areas may result from single and combined factors related to the driver, vehicle, and road environment. For example, more fatal crashes may occur in rural areas because older drivers susceptible to fatal injury are involved in more rural crashes compared to urban crashes. Also, more fatal crashes may occur in rural areas because of the higher incidence of trucks that can be prone to roll-over fatalities on curves due to their high center of gravity and the higher incidence of motorcycles that have less occupant protection than other vehicle types.

Table 2. Distinctive characteristics of fatal rural crashes compared to urban fatal crashes.[9]

Characteristic	Rural fatal crash
Driver demographic	Young (see Footnote 10) or old (≥ 65 years)
Vehicle type	Light truck, heavy truck, motorcycle
Vehicle maneuver	Curve
Crash description	Head on; single-vehicle off-roadway (SVOR); vehicle rollover; Animal impact (Figure 1)
Road environment	Highway; county road; loose/gravel surface (Figure 1)
Occupant ejection	Ejected; dead at scene
Vehicle damage	Severe deformity, towed from scene

Rural crash factors

Several factors have been identified to explain the high incidence and differentiating characteristics of fatal rural crashes (Whylie and Kimball 1997).

Road environment

There are several attributes of the rural road environment that increase the risk of fatal crashes: population density, geographic isolation, and road design (also see "other" factors in Figure 1). Together, these environmental factors not only increase the perceptual, cognitive, and response demands that may prompt a crash (Khorashadi, Niemeier, Shankar, and Mannering 2005), but also introduce hazardous physical elements of roadway design that can increase the severity of the crash outcome (GAO 2004).

First, the population density in rural areas tends to be lower and more geographically isolated than in urban areas (Clark 2003; Weisheit et al. 2006), which implies the need for longer travel distances within rural communities. For example, Kmet and Macarther (2006) cite research indicating similar *percentages* of children in rural and urban areas that are driven to school in

[9] In interpreting this table, it should be noted that some studies differentiate attributes by comparing the percentage of rural and urban cases with an attribute (e.g., Burgess 2005; Muelleman and Mueller 1996) while others compare the crash risk (per 100 VMT) for an attribute in rural and urban areas (Zwerling et al. 2005). These different methods of differentiating rural and urban characteristics can lead to inconsistencies. For example, Zwerling et al., (2005; see also Kmet Macarthur 2006) demonstrate that the *fatal crash rate* per 100 million VMT is higher for young drivers (< 25 years) in rural areas whereas Meulleman and Mueller (1996) demonstrate that a significantly higher percentage of fatal crashes in urban areas involve young drivers (≤ 25 years).

passenger vehicles, but a significantly higher average *travel distance and duration* is higher in the rural areas. Similarly, Gary et al. (2003) suggest that the need of residents in remote (rural) counties to access services in (distant) urban counties increases their travel exposure, with a commensurate increase in the per capita crash rate (since exposure alone may be associated with crash risk, Elvik and Vaa 2004).10

Second, the design of rural roads is generally more hazardous (GAO 2004) as well as visually complex and cognitively demanding than urban road environments (Horrey and Wickens 2003). For example, rural roads may be narrow with curves and hills that restrict sight distances and have small or absent shoulders on roadsides with ditches or obstacles such as trees and utility poles (GAO 2004). The presence of these roadway features has been statistically demonstrated to increase both the frequency and severity of specific types of fatal crashes on rural highways (Lee and Mannering 2002). Notably, in the presence of a (unintended) lane departure, the absence of a median increases the chance of a head-on collision and the absence of a shoulder increases the chance of a run-off-road crash and a vehicle rollover (GAO 2004; Lee and Mannering 2002). The hazard posed by these rural road features may also be exacerbated by reduced visibility and traction during poor weather conditions (see Figure 1).

Emergency medical services (EMS)

Low population density and geographic isolation also directly impact the performance of emergency medical services (EMS) in rural areas. Notably, crashes in isolated rural areas with low traffic volumes may take longer to detect and subsequently notify EMS (Champion et al. 1999). These population and geographic factors also may make it economically infeasible to maintain 24-hour EMS in all rural counties (Svenson, Spurlock, and Nypaver 1996). Consequently, some rural counties will either not have EMS services or will rely on volunteer emergency medical technicians (Grossman et al. 1997). As a result, EMS arrival and transport times can be longer in rural areas because travel distances are further and additional time may be required to coordinate volunteer EMT services (Grossman et al. 1997). In fact, detection, arrival, and transportation times for rural crashes are almost double those for urban crashes (Champion et al. 1999; Grossman et al. 1997).11 As a result, only 7% of rural fatalities are transported to the hospital within the critical "golden hour" recommended for effective medical care after the crash in comparison to 30% of urban fatalities (Champion et al. 1999). Thus, the proximity *rather than the quality* of acute trauma care appears to be a significant factor contributing to the fatal outcomes of rural crashes (Chen et al. 1995). However, this contribution may be less than the effect of road design, driver behavior, and crash type (Donaldson et al. 2006).

[10] Note that Gary et al. (2003) actually defined counties as "wet" (permitting alcohol sales) or "dry" (prohibiting alcohol sales), but admitted that these classifications were consistent with possible urban and rural classifications based on demographics.

[11] Furthermore, Grossman et al. (1997) report that the time at the crash scene is 16% longer in rural areas, which may result from the difficult rural geography and high severity of rural crashes (NHTSA 1996).

Human factors

Historically, there has been more attention given to environment and EMS factors related to rural fatal crashes compared to human factors (Stevenson and Palamara 2001). Human factors can be defined in terms of the state of driver impairment and the behaviors committed by the driver.

Driver state

Figure 1 presents the relative risk (risk ratio) that a specific driver state or driving behavior (human factors) identified with a fatal crash on a rural roadway function class compared to an urban roadway function class (2004 FARS data). Although this is a rudimentary analysis,12 it does suggest that the proportion of fatal rural crashes attributed to a human factor is higher relative to the proportion attributed to fatal urban crashes. For example, the risk of driver fatigue and inattention is significantly higher in fatal rural crashes relative to fatal urban crashes (see also Donaldson et al. 2006, Table 4). It is possible that the longer travel distances associated with rural travel increases driver fatigue (Donaldson et al. 2006) and opportunities for distraction (perhaps related to fatigue). The higher prevalence of driver fatigue may also be due to commuting to jobs located outside rural areas during high-risk periods in the circadian rhythm (Ward and Smith 2000).

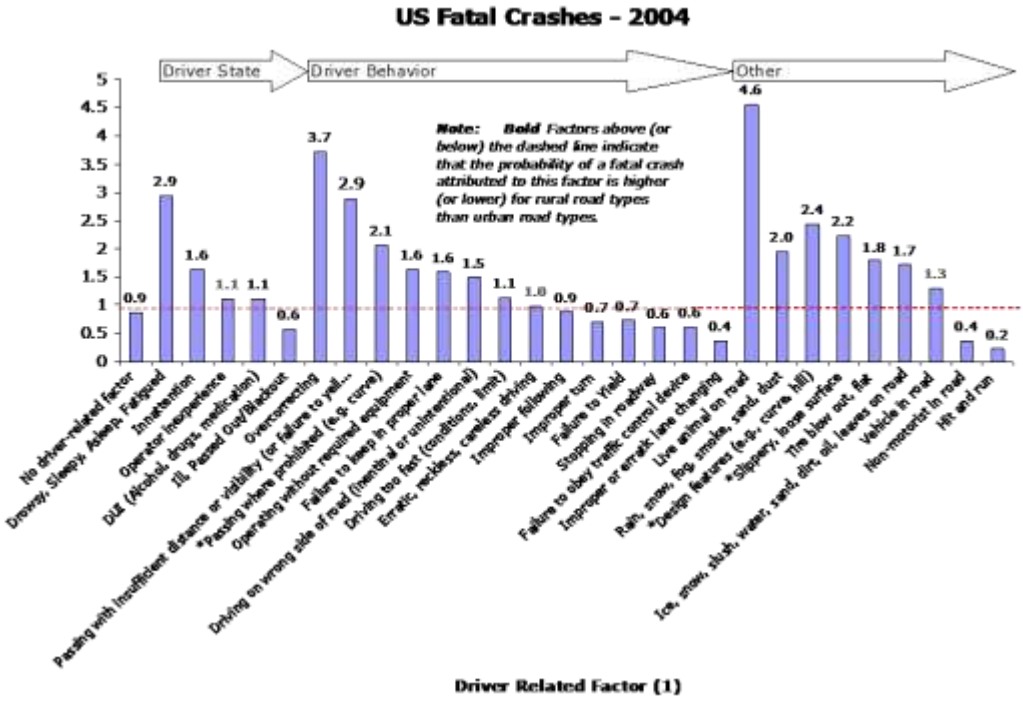


Figure 1. Risk ratios comparing the probability of attributing driver-related factors in rural and

[12] This analysis only considered the first "Driver Related Factor 1"data field and only presents factors representing more than 100 fatal crashes in total (*for illustrative purposes, some attributions are included with less than 100 cases). Cases with blank entries or unknown roadway types are excluded. Relative risk was computed as the ratio between the proportion of fatal crashes on rural roads with a specific factor (a_{rural}/b_{rural}, where a is the number of fatal rural crashes with the specific factor and b is the total number of rural fatal crashes) and the proportion for the same factor on urban roads (a_{urban}/b_{urban}). The 95th percentile confidence interval was computed to determine if the relative risk was statistically significant (i.e., confidence interval range did not include 1.0).

urban fatal crashes (FARS 2004).

It is notable that the relative risk of an impaired driver state resulting from alcohol, drugs, and medicines (DUI) is also significantly higher in rural fatal crashes (see also Donaldson et al. 2006, Table 4). This is consistent with previous crash analyses that indicate that the majority of all *alcohol-related traffic fatalities* (63%) occur in rural areas (GAO 2004). Moreover, the *DUI arrest rate per capita* is higher in rural counties than in larger urban counties (Weisheit et al. 2006, Figure 3.6). Thus, alcohol (and other forms of intoxication) is a significant contributing factor for fatal rural crashes. Specifically, alcohol in addition to driver fatigue and inattention are the primary human factors that contribute to single-vehicle off-roadway (SVOR) crashes (Campbell, Smith, and Najm 2003), which is a common fatal crash type in rural areas (see Table 2).

Driver behavior

Driver behaviors can be classified both as a factor *contributing* to a crash and as a factor *mitigating* the severity of the crash (Whylie and Kimball 1997). In terms of contributing factors, it is apparent from Figure 1 that "overcorrecting" is major behavioral factor for fatal rural crashes. Other high risk behavioral factors that predominate in fatal rural crashes involve unsafe passing, improper lane control, and driving on the wrong side of the road. Logically, these behaviors are related to head-on crashes, which is another common fatal crash type in rural areas (see Table 2).[13]

Figure 1 also shows that the relative risk of "driving too fast" is significantly higher for fatal crashes on rural road types than urban road types (see also Donaldson et al. 2006, Table 4). This rural propensity for fatal high speed crashes may be expected give that there is an intrinsic relationship between speed, crash risk, and crash severity (Aarts and Schagen 2006) considering that the design of the rural road environment (lower traffic volumes and higher posted speed limits) may afford faster driving speeds (Baystate Roads Program 2006). Consequently, most speed-related traffic fatalities (62%) are on rural roads (GAO 2004) with collector and local roads in rural areas having *speed-related fatality rates* (per 100 million VMT) that are nearly four times higher than for the same road types in urban areas (Baystate Roads Program 2006). Thus, excessive speed is a contributing human factor, especially for SVOR crashes (Campbell, Smith, and Najm 2003), which is a common fatal crash type in rural areas (see Table 2).

Seat belts are a common form of mandated restraint system in modern vehicles. In terms of mitigating factors, research has consistently documented that restraint systems such as seat belts can reduce the severity of a crash (NSC 2006). American roadside surveys of seat belt compliance have shown similar percentages of rural and urban motorists using seat belts (Coben 2006; TRIP 2005), although there is a general trend for lower compliance amongst rural motorists (Glassbrenner 2004; Transport Canada 2006). Seat belt use is also generally lower amongst drivers of pick-up trucks than other vehicle types (Coben 2006; NHTSA 2006a). Notably, this difference between vehicle types is most pronounced in rural areas (Transport Canada 2006) with seat belt use amongst pick-up truck drivers being "considerably lower" in

[13] Thus, overcorrecting as a risk factor may arise when drivers—perhaps impaired—attempt to (1) recover from unsafe passing, improper lane control or driving on the wrong side of the road, (2) avoid hazards in the rural road environment, such as avoiding live animals on the roadway, or (3) respond to loss of traction or vehicle control (see "other" factors in Figure 1 and Table 2).

rural areas (54%) compared to non-rural areas (69%) (NHTSA 2006b). Furthermore, seat belt use is generally lower amongst *occupant fatalities* in rural crashes than in urban crashes (Donaldson et al. 2006; Muelleman and Mueller 1996). For example (see Figure 1), the relative risk (risk ratio) of restraint system non-use between rural and urban traffic fatalities (based on 2004 FARS data) was 1.16 (95^{th} CI: 1.15–1.18) indicating a significantly lower probability of restraint system use in rural traffic fatalities. As a result, the percentage of fatal vehicle occupant ejections is generally higher in rural crashes than in urban crashes (Coben 2006), with most fatal ejections from pick up trucks (93%) involving occupants that were unbelted (NTHSA 2006b).[14]

It is important to note these discussed human factors are not "passive". That is, in many instances, drivers knowingly accept the impairment state and deliberately engage in high-risk behaviors. This assertion can be framed in terms of a simple model of driving in which the driver is expected to perceive relevant information in the environment, decide on the appropriate response, and engage the corresponding behavior. Thus, crash risk can increase if the driver does not perceive a hazard, decides on an inappropriate response, or is unable to perform the necessary behavior (Sander and McCormick 1992).

In these terms, there is no doubt that some crashes result from the driver not perceiving a hazard in the environment such as a stopped vehicle in the lane. There may also be some cases when novice drivers cannot perform the necessary behavior correctly. However, many crashes actually result from the deliberate decision of the driver to take a risk despite perceiving a hazard and having the ability to be safe (see Figure 21-2 of Sander and McCormick 1992). For example, most cases of drinking and driving are deliberate; that is, most drivers that consume alcohol before driving are aware that alcohol impairs performance. Many cases of speeding are also deliberate; that is, most drivers that speed are aware of the posted limit and the laws enforcing speed compliance. Similarly, most cases of seat belt non-use are deliberate; that is, drivers are aware of the seat belts present in the vehicle and the laws enforcing seat belt compliance. These examples demonstrate that a significant proportion of crashes may result from the decision of the driver to take risks for some form of expected benefit (Wilde 1992). The critical issue for safety is then to determine the psychological processes that result in risky decisions and the influence that culture has on directing these processes.

Rural safety culture

From the preceding discussion it is apparent that rural fatal crashes are often the result of dangerous human factors occurring in hazardous rural road environments that impede EMS performance. In this context, it is necessary to consider the entire transportation system. Typically, safety improvement strategies for rural areas have been directed to improving road design (AASHTO 2006) and to making EMS more effective (Champion et al. 1999). In contrast, relatively less research has been directed at driver state and behavioral factors (Stevenson and Palamara 2001). In particular, there has not been sufficient attention to the cultural factors that embody rural communities (Hartley 2004) and propagate those beliefs and attitudes that promote driver acceptance of impaired states and commission of dangerous behaviors. Research to

[14] These data indicate the fast speed and high severity of rural crashes have a significant impact on the effectiveness of restraint systems. The data may also suggest that (rural) drivers that decide not to use restraint systems may also be predisposed to fatal crashes.

understand the effect of culture on crash risk must first define "culture" and its influence on belief structures before modeling the effect of these structures on influencing the human factors that contribute to fatal crashes.

This socio-cultural context is "embedded in relationships that tie individuals to organizations, neighborhoods, families, and friends in their community" (Salmon and Mullan 1992 as cited by Hartley 2004). As discussed in relation to Table 1, rural communities tend to be more isolated with lower population densities and socioeconomic levels, but more dense social linkages compared to urban communities (Weisheit et al. 2006). These rural demographic and social structures may foster different forms of social relationships, which result in a culture that is distinct from urban areas. This rural culture can be expected to manifest different safety attitudes and driving behaviors than urban cultures.

Culture has been defined as the belief (value) structure, shared ideals, and "directives for action" that are embodied by a community (Bealer et al. 1965).

Arguably, the belief structures embedded in the prevailing culture has a significant impact on the decision making process of the driver to accept risks. Specifically, beliefs about high benefits and low costs associated with risky behavior may support decisions based on higher risk acceptance (see Figure 4.2 of Wilde 1992). Beliefs based on a fatalistic perspective that events are predetermined may reduce risk mitigation behaviors (Lund and Aarø 2003). This effect of belief structures on decision-making in the context of driving was recently demonstrated in a survey comparing the attitudes and reported behavior of rural and urban drives conducted by the University of Minnesota based on nearly 1,600 current residents from a total of 3 urban and 3 rural counties (Rakauskas 2006). The results indicated that the rural county residents believed that not wearing a seat belt was significantly less dangerous than the urban residents. Indeed, beliefs about the dangerousness of non-use were correlated with reported frequency of non-compliance across all residents. As a result, seat belt compliance was also significantly lower amongst rural residents consistent with earlier reported data from observational studies (Eby, Vivoda, and Cavanagh 2005). Thus, beliefs that the risk of not wearing a seat is low appeared to be the basis of decisions to not to wear them. The higher non-compliance rate amongst rural residents may possibly be attributed to the fatalistic view that may be evident in rural areas (see Table 1). This view may lead to the belief that crash fatalities are inevitable, thereby reducing the apparent utility of seat belt use.

Once a culture has been defined and its influence of the formation of belief structures has been characterized, it is then necessary to develop a model for relating those belief structures to the emergence of impaired states and the commission of unsafe behaviors. The Theory of Planned Behaviors (TPB) is a commonly used framework to describe the underlying process of belief structures that influence intentional health-related behaviors (Conner and Sparks 2005) including driving behaviors such as speeding (Conner et al. in press). The TPB proposes that behaviors are the result of intentions to act based on attitudes toward the object or outcome of that behavior as well as perceptions of control and subjective norms for behavior. These psychological determinants of intention and behavior emerge from belief structures representing the perceived (1) consequence of committing the behaviors (Behavioral Beliefs), (2) expectations from significant others regarding commission of the behavior (Normative Beliefs), and (3) availability of resources to achieve the behavior (Control Beliefs). These belief structures may arise from the personality of the individual and the culture of the community (that emerges from the

relationships engendered by the demographic and social structures of the region). This model suggests that safety interventions based on the socio-cultural context should modify driver belief structures in order to naturally support safe decisions by reducing the acceptability of risk. Consistent with this proposal, Lund and Aarø (2003) conducted an extensive review of attitude modification methods to improve safe behavior in workplace and driving domains. This review demonstrated that the modification of belief and social structures through the provision of information, social norm referents, and incentive/penalty schemes can significantly improve safety behaviors and acceptance of safety interventions (see Figure 1 of Lund and Aarø 2003). Lund and Aarø (2003) conclude that there is a dynamic relationship between culture and other factors affecting safety (p. 314) that must be considered when developing safety interventions:

> *"Changes in other factors tend to influence culture, and aspects of the culture may enhance or obstruct establishment of preventative measures. It is a challenge to identify cultural dimensions that may have an impact on safety practices. Such factors have to be taken into account when planning preventative action. In the long term, changes in such cultural factors may prove to be a prerequisite for effectively promoting safety with a country or culture."*

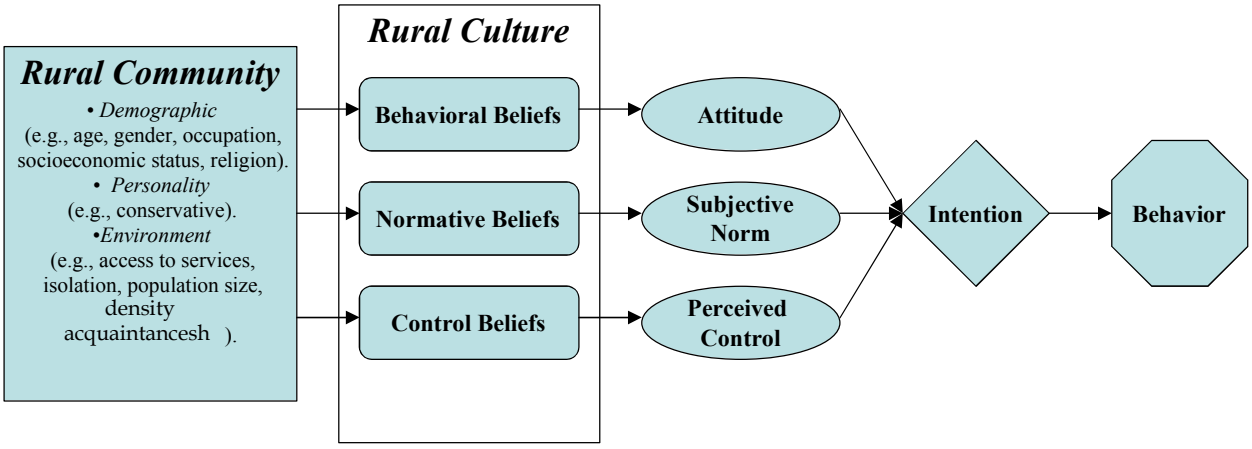


Figure 2. Possible framework related rural culture to traffic safety behaviors (adapted from Conner and Sparks 2005).

Summary and recommendations

In summary, the risk of a crash being fatal in rural areas appears to be the joint function of drivers committing dangerous behaviors (perhaps related to an impaired state) that result in high-severity types of crash in hazardous road environments that impedes EMS access. With traffic safety aligned to public health, it is important to consider the role of the socio-cultural context in enabling safe driving attitudes and behaviors as it is for any other form of health-related behavior (Hartley 2004). Accordingly, this chapter proposes that there may be a distinctive rural safety culture embodying a belief structure, which promotes driver states and driving behavior that may not only increase crash risk, but also inhibit mitigating behavior that can reduce crash severity. Thus, in order to improve traffic safety in the rural traffic system, it is necessary to not only improve road design and EMS capabilities, but also seek interventions to reduce risks associated with human factors. The design and implementation of interventions to target these factors must

take into account the cultural context that provides the psychological impetus for rural drivers to decide to be unsafe. Toward this end, the following recommendations are made for future research in order to reduce traffic fatalities in rural communities by supporting the driver to make safe decisions and value traffic safety:

- Identify the human factors specific to the types of fatal crash most common in rural areas. This examination must also consider relationships between crash factors. This includes not only the inter-relationship between human factors (e.g., the relationship between alcohol, speed, and poor lane control), but also the relationship between human factors and environmental factors (e.g., the relationship between fatigue, overcorrection, and poor road conditions due to weather). This research should consider differences within rural areas, as well as between rural and urban areas.
- Develop a framework to describe and measure *contemporary* traffic safety cultures that are sufficiently representative of rural communities and differentiated from urban communities. This framework should articulate which regional characteristics influence cultural development and how cultures engender belief structures that are relevant to the prediction of human factors related to fatal crashes. However, "it must be recognized that precisely measuring and describing a local culture is extremely difficult and it would be a mistake to argue there is a single rural culture in the United States" (Weisheit et al. 2006, p. 40). Therefore, this framework should be flexible and not prescriptive.
- As demonstrated in Figure 2, apply this rural culture framework within a decision-making model of health-behavior to predict intentional behaviors related to fatal crash risk. The level of specificity for this model should be sufficient to identify belief structures and associated attitudes, perceptions, and norms that could be modified with socio-cultural interventions based on relevant theory and methodologies of the social and psychological sciences.
- Develop these socio-cultural interventions as community-based programs to modify unsafe behaviors. Basing these programs in the community is necessary in order to have access to the determinants of the salient belief structures and to increase community acceptance (e.g., FHWA 2006; NHTSA 2006c).

References

Aarts, L., and I. van Schagen. 2006. Driving speed and the risk of road crashes: A review. *Accident Analysis and Prevention* 38:215–24.

AASHTO. 2001. *A policy on geometric design of highways and streets* (fourth edition). Washington, DC: American Association of State Highway and Transportation Officials.

———. 2006. *Run-off-road collisions: Executive summary*. Accessed August 29, 2006. http://safety.transportation.org/htmlguides/RORcrashes/exec_sum.htm.

Baystate Roads Program. 2006. *Speeding counts on all roads* (Tech Note #26). Amherst, MA: University of Massachusetts, Amherst. Report downloaded on August 24, 2006. http://www.tripnet.org/RuralRoads2005Report.pdfwww.ecs.umass.edu/baystate_roads/technotes/26_speeding_counts.pdf.

Bealer, R. C., F. K. Willits, and W. P. Kuvlesky. 1965. The meaning of "rurality" in American society: Some implications of alternative definitions. *Rural Sociology* 30:255–66.

Blatt, J. and S. M. Furman. 1998. Residence location of drivers involved in fatal crashes. *Accident Analysis and Prevention* 30:705–11.

Blumer, H. 1953. What is wrong with social theory? *American Sociological Review* 19:3–10.

Brown, L. H. (EMT-P), A. Khanna, and R. C. Hunt. 2000. Rural vs. urban motor vehicle crash death rates: 20 years of FARS data. *Prehospital Emergency Care* 4:7–13.

Burgess, M. 2005. *Contrasting rural and urban fatal crashes 1993–2004* (DOT HS 809 896). Washington, DC. National Center for Statistics and Analysis, US Department of Transportation.

Campbell, B. N., J. D. Smith, and W. G. Najm. 2003. *Examination of crash contributing factors using national crash databases* (DOT HS 809 664). Washington, DC: NHTSA, US Department of Transportation.

Census. 2006. *Definition: Urban and rural*. Accessed from question and answer section of www.census.gov on August 10, 2006 (Traffic facts).

Champion, H. R., J. S. Augenstien, B. Cushing, R. Hunt, R. Larkin, A. C. Malliaris, W. J. Sacco, and J. H. Siegel. 1999. Reducing highway deaths and disabilities with automatic wireless transmission of serious injury probability ratings from crash recorders to emergency medical services providers. *International Symposium on Transportation Recorders* (May 3–5). Arlington, VA.

Chen, B., R. F. Maio, P. E. Green, and R. E. Burney. 1995. Geographic variation in preventable deaths from motor vehicle crashes. *Journal of Trauma: Injury, Infection, and Critical Care* 38:228–32.

Clark, D. E. 2003. Effect of population density on mortality after motor vehicle collisions. *Accident Analysis and Prevention* 35:965–71.

Coben, J. H. 2006. Commentary: Contrasting rural and urban fatal crashes: Scenic beauty or dead at the scene? *Annals of Emergency Medicine* 47:575–7.

Conner, M., and P. Sparks. 2005. The theory of planned behaviour and health behaviours. In M. Conner and P. Norman, eds. *Predicting health behaviour: Research and practice with social cognition models* (2nd edn., pp. 170–222). Maidenhead: Open University Press.

Conner, M., R. Lawton, D. Parker, K. Chorlton, A. S. R. Manstead, and S. Stradling. in press. Application of the theory of planned behaviour to the prediction of objectively assessed breaking of posted speed limits. *British Journal of Psychology*.

Deavers, K. 1992. What is rural? *Policy Studies Journal* 20:184–9.

Donaldson, A. E., L. J. Cook, C. B. Hutchings, and J. M. Dean. 2006. Crossing county lines: The impact of crash location and driver's residence on motor vehicle crash fatality. *Accident Analysis and Prevention* 38:723–7.

Eby, D.W., Vivoda, J.M., & Cavanagh, J. 2005. *Minnesota safety belt and motorcycle helmet use*. Accessed from Minessota Office of Traffic Safety, January 5, 2006: www.dps.state.mn.us/ots/topic_areas/belts/belts_default.asp.

Elvik, R., and T. Vaa, eds. 2004. *The Handbook of Road Safety Measures*. Kidlington, Oxford: Elsevier Ltd.

FHWA. 2006. *Serving rural America: Promoting and improving safety*. Accessed August 29, 2006 http://www.fhwa.dot.gov/planning/rural/ruralamerica/3promoting.html.

GAO. 2004. *Highway safety: Federal and state efforts to address rural road safety challenges* (GAO-04-663). United States General Accounting Office. www.gao.gov/cgi-bin/getrpt?GAO-04-663.

Gary, S. L. S., L. Aultman-Hall, M. McCourt, and N. Stamatiadis. 2003. Consideration of driver home county prohibition and alcohol-related vehicle crashes. *Accident Analysis and Prevention* 35:641–8.

Glassbrenner, D. 2004. *Safety belt use in 2003—Demographic characteristics* (DOT HS 809 729). Washington, DC: NHTSA, US Department of Transportation.

Grossman, D. C., A. Kim, S. C. Macdonald, P. Klein, M. K. Copass, and R. V. Maier. 1997. Urban-rural differences in prehospital care of major trauma. *Journal of Trauma: Injury, Infection, and Critical Care* 42:723–9.

Hartley, D. 2004. Rural health disparities, population health, and rural culture. *American Journal of Public Health* 94:1675–8.

Horrey, W. J. and C. D. Wickens. 2003. Multiple resource modeling of task interference in vehicle control, hazard awareness and in-vehicle task performance. *Proceedings of the Second International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design*, Park City, Utah, 7–12.

IIHS. 2006. *Q&A: Urban crashes* (January, 2006). Accessed August 10, 2006. www.iihs.org/research/qanda/urban.html.

Khorashidi, A., D. Niemeier, V. Shankar, and F. Mannering. 2005. Differences in rural and urban driver-injury severities in accidents involving large trucks: An explanatory analysis. *Accident Analysis and Prevention* 37:910–21.

Kmet, L., and C. Macarthur. 2006. Urban-rural differences in motor vehicle crash fatality and hospitalization rates among children and youth. *Accident Analysis and Prevention* 38:122–7.

Lajunen, T., D. Parker, and H. Summala. 2004. The Manchester driver behavior questionnaire: A cross-cultural study. *Accident Analysis and Prevention* 36:231–8.

Lee, J., and F. Mannering. 2002. Impact of roadside features on the frequency and severity of run-off-roadway accidents: An empirical analysis. *Accident Analysis and Prevention* 34:149–61.

Lund, J., and L. E. Aarø, 2003. Accident prevention: Presentation of a model placing emphasis on human, structural and cultural factors. *Safety Science* 42:271–324.

Miller, M. K., and A. E. Luloff. 1981. Who is rural? A typological approach to the examination of rurality. *Rural Sociology* 46:608–25.

Muelleman, R. L., and K. Mueller. 1996. Fatal motor vehicle crashes: Variations of crash characteristics within rural regions of different population densities. *Journal of Trauma: Injury, Infection, and Critical Care* 41:315–20.

NHTSA. 1996. *Rural and urban crashes—A comparative analysis*. Research Note (August). Washington, DC: US Department of Transportation.

———. 2004. Rural/urban comparison. *Traffic safety facts: 2004 data* (DOT HS 89-938). Washington, DC. US Department of Transportation.

———. 2006a. *Rural pick up truck drivers and safety belt use: Focus group report*. Accessed on August 24, 2006. www.nhtsa.dot.gov/People/injury/airbags/RuralPickUpTruckupdate/ExecutiveSummary.htm.

———. 2006b. *Safety belts and rural communities—2003 report*. Accessed from www.nhtsa.dot.gov on August 24, 2006: http://www.nhtsa.dot.gov/people/injury/airbags/BUASBRuralWeb/.

———. 2006c. *Safe communities: Rural issues*. Accessed August 29, 2006. www.nhtsa.gov/safecommunities/servicecenter/folios/ruralissues.htm.

NSC. 2002. *Injury facts 2002*. National Safety Council.

———. 2006. *Why seat belts?* Accessed August 10, 2006. http://www.nsc.org/traf/sbc/sbcwhy.htm.

Page, Y. 2001. A statistical model to compare road mortality in OECD countries. *Accident Analysis and Prevention* 33:371–85.

Peden, M. et al., eds. 2004. *World report on road traffic injury prevention: Summary*. World Health Organization, Geneva, Switzerland.

Rakauskas, M. E. 2006. *Safety culture differences between rural and urban populations*. Unpublished white paper for First Year Research Requirement, Cognitive and Biological Psychology PhD Program, University of Minnesota.

Roth, J. P., and L. Elgert. 2003. Determinism, risk and safe driving behavior in Northern Alberta, Canada. *International Journal of Circumpolar Health* 62:268–75.

Sanders, M. S. and E. J. McÇormick. 1992. *Human factors in engineering and design* (7th Edition). New York, NY: McGraw-Hill Inc.

Stevenson, M. R., and P. Palamara. 2001. Behavioral factors as predictors of motor vehicle crashes: Differential between young urban and rural drivers. *Australian and New Zealand Journal of Public Health* 25:245–9.

Svenson, J. E., C. Spurlock, and M. Nypaver. 1996. Factors associated with the higher traumatic death rate among rural children. *Annals of Emergency Medicine* 27:625–1996.

Transport Canada. 2006. *Transport Canada's surveys of seat belt use in Canada 2004–2005* (RS-2006-01E). Ottawa, Canada: Transport Canada.

TRIP. 2005. *Growing traffic in rural America: Safety, mobility, and economic challenges in America's heartland*. Washington, DC: The Road Information Program. Report downloaded on August 24, 2006. www.tripnet.org/RuralRoads2005Report.pdf.

USDA. 2006. *Rural America at a glance—2005*. Report accessed from www.ers.usda.gov on August 10, 2006: http://www.ers.usda.gov/publications/EIB4/EIB4_lowres.pdf.

Ward, N. J., and L. Smith. 2000. Shift work and driver fatigue. *Proceedings of International Conference on Traffic and Transport Psychology*, Berne, Switzerland (September 4–7).

Weisheit, R. A., D. N. Falcone, and L. E. Wells. 2006. *Crime and policing in rural and small-town America*. Long Grove, Il: Waveland Press Inc.

Whylie, M. A. T., and R. B. Kimball. 1997. Rural motor vehicle crashes: Can we prevent them? *Journal of Emergency Nursing* 23:542–4.

Wilde, J.G.S. 1994. *Target Risk*. Kingston, ON: PDE Publications.

Wilkinson, K. P. 1991. *The community in rural America*. New York, NY: Greenwood Press.

Zwerling, C., C. Peek-Asa, P. S. Whitten, S. W. Choi, N. L. Sprince, and M. P. Jones. 2005. Fatal motor vehicle crashes in rural and urban areas: Decomposing rates into contributing factors. *Injury Prevention* 11:24–28.

Biographical statement

Nicholas J. Ward is Director of the ITS Institute's HumanFIRST Program at the University of Minnesota. This program comprises a multi-disciplinary team of University researchers and visiting scholars, utilizing a state-of-the-art driving simulator as well as instrumented vehicles for test track and field study research. The program takes a human-centered approach to improving traffic safety, focusing on the cognitive functioning of the driver as the center of the transportation system. These efforts are targeted at understanding the psychological bases of driver behavior, risk taking, and impairment in order to design safety interventions based on education, enforcement, engineering, and intelligent transportation systems. Current HumanFIRST research includes driver distraction, alcohol impairment, driver support systems, older and novice drivers, and measurement of driver safety cultures.

Ward obtained his Ph.D. in Human Factors psychology from Queen’s University (Canada) with a dissertation on driver visual behavior at rural railway crossings. He then spent more than eight years conducting human factors research in transportation safety and Intelligent Transportation Systems at the University of Leeds. This research focused on driver impairment, risk perception, driver aggression, assessment of older drivers, and the design and usability evaluation of ITS applications.

Changing America's culture of speed on the roads

Barbara Harsha

Governors Highway Safety Association

James Hedlund

Highway Safety North

Overview

Speeding—exceeding the posted speed limit or traveling too fast for conditions—is epidemic on America's highways. Most drivers understand that speeding is dangerous, and most drivers feel that other speeders threaten their own personal safety. Yet most drivers speed: in a recent national survey, about 80% of all drivers said they exceeded the speed limit on all types of roads, from Interstate highways to neighborhood streets, within the past month, and about one-third reported that they were speeding on the day of the interview. Speeding increases both the risk of a crash and the risk of injuries and fatalities in crashes. Speeding was documented in almost one-third of all fatal traffic crashes in 2005 and probably was involved in many more.

American culture encourages speeding. Many roads are designed for speeds higher than the posted speed limit. Cars are comfortable, quiet, insulated from the road, with speedometers recording speeds over 100 mph; drivers don't feel that they are traveling fast. Television, movies, and electronic games all promote speeding. Automobile companies and car magazines advertise speed through slogans such as "0 to 60 mph in 3.4 seconds." And Americans' busy lifestyles stress that every minute counts, that in days filled with multiple appointments in different locations, we need to get from one place to the next as quickly as we can—so we speed.

Current methods for controlling speeding are virtually powerless in the face of this speeding culture. Police can detect speeders easily, but police can patrol only a tiny fraction of the nation's four million highway miles. On congested multilane roads, police cannot safely single out one car from the hundreds that speed by every minute. The common attitude is that police issue speeding tickets to raise revenue, not to protect the driving public. Automated speed enforcement has demonstrated its effectiveness in other countries but is used only rarely in America.

So what can be done to reduce speeding? The public's attitudes that accept and often encourage speeding must change, and at the same time speeding behavior must be reduced and stopped in locations and situations where the public knows that speeding is dangerous. Two good targets are 1) specific high-visibility locations, such as school zones, neighborhood streets where children live, highway work zones, and streets with heavy pedestrian crossing traffic and 2) extreme speeders who drive more than ten or twenty mph faster than other vehicles. Well-publicized campaigns focused on these targets, using both manned and automated enforcement methods, can begin changing public attitudes. They require vigorous local, state, and national leadership that recognizes the true role of speed in traffic crashes and injuries, makes speed a real safety

priority, increases funding for speed-related programs and research, and uses leadership's "bully pulpit" to inform, encourage, and inspire America's drivers to drive at safe speeds.

Introduction and background

What is speeding?

To much of the public, speeding is like pornography: difficult to define, but we know it when we see it. And to many drivers, speeding is something that other people do: I may drive fast on occasion, but I always drive safely, you occasionally speed dangerously, he drives like a maniac.

The formal definition of speeding, and the basis on which speeding citations are written, is exceeding the posted speed limit or driving too fast for conditions. All United States roads have a speed limit, established by the state or municipality (TRB 1998, 21). General speed limits apply to all roads in a class, such as rural Interstates or local streets. States and municipalities may establish speed zones with different speed limits on road segments where they determine that the general speed limit for the road class is too high or too low for that segment.

Although speed limits should establish the maximum safe speed on every road segment and, consequently, should define speeding clearly, in practice they often do not. General speed limits may well be too high or too low for specific road segments. States and municipalities do not establish speed zones for many of these road segments: they don't have the resources to conduct engineering assessments and post speed-limit signs, they believe that changing speed limits every few miles would confuse drivers, or they react to public pressure to maintain general speed limits (TRB 1998, 82). Consequently, many drivers believe that they will not be ticketed for speeds less than five or sometimes ten mph over the posted limit (Royal 2004). This belief is correct: police in most jurisdictions have an informal and unwritten "speeding tolerance" over the posted speed limit and they will not write a ticket unless a driver exceeds this tolerance (GHSA 2005).

Because neither drivers nor police believe that speed limits mean what they say, it's no surprise that speed limits are widely, and on some roads almost universally, ignored. Most drivers admit to speeding on all types of roads.

Driving too fast for conditions—the second part of the speeding definition—is far more subjective but is useful because it attempts to identify where and when speeding is dangerous. The best estimates of how frequently it occurs come from crash data. NHTSA considers a crash to be speeding-related if a driver was charged with a speeding-related offense or if the investigating officer indicated that racing, driving too fast for conditions, or exceeding the posted speed contributed to the crash. Using this definition, NHTSA estimated that speeding was involved in 30% of fatal crashes in 2005 and that speeding-related crashes claimed 13,113 lives (NHTSA

2006). Law enforcement officers consider the true role of speeding to be much greater than this. In their experience, speeding is involved in almost all serious crashes.

The consequences of speeding

Speeding affects both the probability of a crash and the severity of injuries produced by a crash. Over 100 studies, summarized in Elvik (2005) and Aarts and van Schagen (2006), document three effects of speed on crashes and injuries. First, the probability of a crash is approximately proportional to the square of the travel speed. Second, in a crash, injury risk is approximately proportional to the impact forces on a person, which in turn are proportional to the square of the impact speed. These two effects can be summarized in a general rule of thumb:

> *When travel speed increases by 1%, the injury crash rate increases by about 2%, the serious injury crash rate increases by about 3%, and the fatal crash rate increases by about 4%.*

The same relation holds in reverse: a 1% decrease in travel speed reduces injury crashes by about 2%, serious injury crashes by about 3%, and fatal crashes by about 4%. Consider the effect on a street with a speed limit of 35 mph and average travel speed of 40 mph. A reduction of just 2 mph, to 38 mph, is a 5% decrease, so crashes would be reduced by about 10%, serious injury crashes by about 14%, and fatal crashes by about 19%.

Finally, the probability of a crash increases as a vehicle's travel speed rises above the average travel speed of surrounding vehicles. Extreme speeders have very high crash risks. For example, someone speeding at 80 mph on a road with average speed 70 mph has about a 31% greater crash risk, 49% greater injury crash risk, and 71% greater fatal crash risk than drivers at 70 mph.

Speeding can be dangerous on all roads. In 2004, half of the speed-related traffic fatalities occurred on roads posted at 50 mph or less, and one-fifth occurred on roads posted at 35 mph or less (NHTSA 2005a, Table 118).

What's being done to reduce speeding?

All three of traffic safety's "Three E" strategies—education, enforcement, and engineering—are used in attempts to control speeding. With few exceptions, none has had much effect.

Engineering

Engineering includes designing roadways and establishing speed limits. In America, roadways often are designed and built with little consideration of either the speed limit that will be set or the operating speed that drivers will feel is reasonable and safe (NHTSA 2005b). When setting speed limits, the most important consideration has been (and continues to be) free-flowing travel speeds rather than what speed is, in fact, safe (and the next most important consideration isn't

safety either—it's politics). Precisely, speed limits are set starting with the 85th percentile speed: the speed not exceeded by 85% of drivers (TRB 1988, 91; NHTSA 2005b). This means that speeding drivers can help raise speed limits, rather than speed limits helping to slow down speeding drivers. Thus, both roadway design and speed limits frequently encourage faster driving.

The effects of maximum speed limits on travel speed, crashes, and casualties have been studied extensively over the past 30 years. In 1974, the 55 mph National Maximum Speed Limit (NMSL) was enacted to conserve fuel. Travel and speeds both decreased on roads where the speed limit was lowered to 55 mph. These slower and more uniform speeds are judged to have saved between 3,000 and 5,000 lives in 1974. As fuel became plentiful again, travel increased and compliance with the 55 mph limit decreased markedly. In 1987, Congress allowed States to raise speed limits to 65 mph on rural Interstate highways. States that raised their limits generally saw increases of about 4 mph in average speeds and 85th percentile speeds and statistically significant increases in traffic fatalities on these roads. In 1995, Congress repealed the NMSL and returned full authority to set speed limits back to the States. Again, increased speed limits produced modest increases in both average and 85th percentile speeds and increases in traffic fatalities (TRB 1998, 6).

The few studies that have examined the effects of speed limit changes on lower-speed roads generally found little effect on driving speeds or crash rates when speed limits were raised to near the 85th percentile travel speed or lowered to near the 35th percentile speed, either on rural roads or on urban and suburban arterials (TRB 1998, 6). As the TRB report points out, "the findings suggest the difficulty of altering behavior [on these roads] merely by changing the [speed limit] sign"—that is, without publicized enforcement.

Enforcement

Enforcement relies on police officers observing speeding vehicles. Radar guns allow them to do this quickly and easily. But police can patrol only a tiny fraction of the nation's four million highway miles. When many drivers exceed speed limits every day, an occasional ticket has little effect. Even a police car by the side of the road isn't much help. On congested multilane roads, police cannot safety single out one car from the hundreds that speed by every minute. On roads where speed enforcement is practical, drivers have three standard reactions when they see a police car on the roadside: immediately slow down to the speed limit to attempt to avoid a ticket, flash their lights at oncoming traffic to warn them of the police car, and speed back up within a mile or two.

Automated enforcement with speed cameras has been used quite extensively in other countries but only rarely in America. As of October 2006, only 21 communities in 10 states and the District of Columbia used speed cameras, and some states explicitly prohibited their use (IIHS 2006a, 2006b). Speed cameras have proven their value in other countries. Pilkington and Kinra (2005) reviewed 14 high-quality studies of speed camera programs in Australia, Canada, New Zealand, Norway, and the United Kingdom and concluded that speed cameras reduce traffic crashes, injuries, and fatalities. Wilson et al. (2006) reached similar conclusions from a review of 26 studies. In the United States, though, speed cameras often are opposed by people who believe that they intrude on individual privacy or are an inappropriate use of law enforcement's authority.

Education

Education on speeding comes in two forms: tied to enforcement or stand-alone. Effective, high-visibility communications and outreach are critical if speed enforcement programs are to have much effect. Stand-alone programs urging drivers not to speed, using slogans such as "Speed Shatters Life," are unlikely to have any effect at all (Hedlund 2006, Sec. 3.4.1).

What's the real problem?

So: many if not most American drivers regularly speed, they know they speed, they don't take speed limits or speed limit enforcement seriously, and they generally have not supported automated speed enforcement. What's needed to change our speeding? It's not primarily an issue of how we build roads or vehicles, though our roads and vehicles can play an important role. Rather, it's an issue of how our society depicts and values speed and how society understands or does not understand the consequences of speed. In a word, it's the American *culture* of speed.

The American culture of speed

Speed on the highways is ingrained into many parts of contemporary American culture. It's apparent in the driving public's attitudes, beliefs, and behavior and is supported by our vehicles, our roads and speed limits, and our media. A full catalogue of this speed culture isn't necessary; a few examples in each area will suffice.

Public attitudes and behaviors are documented in NHTSA's 2002 national telephone survey of 4,010 drivers (Royal 2004). Among the findings:

- About 80% of all drivers said they exceeded the speed limit on all types of roads, from Interstate highways to neighborhood streets, within the past month, and about one-third reported that they were speeding on the day of the interview.
- One-third sometimes drive 10 mph faster than most other vehicles and more than half "often get impatient with slow drivers."
- On average, they think they can drive 7–8 mph over the posted speed limit, on any road, without being ticketed for speeding.
- They overwhelmingly agree with current speed limits but also overwhelmingly ignore them: for example, on city or town roads, 83% say that the speed limits are "about right," but 78% have exceeded the limit on roads of this type in the past month.
- Two-thirds felt that other speeding drivers pose a major threat to their personal safety.

As the report concludes, there's "a strong 'it's not me, it's the other guy who is a problem' mentality among many drivers."

Institutions support the public's speeding in many ways.

- The automobile industry builds cars that easily exceed the maximum posted speed limit on any road. Speedometers record speeds as high as 200 mph. As an example, a car parts website lists thirty-two speedometer models of which 22 record a top speed of 160 mph or greater and only one is less than 120 mph. The authors' three very pedestrian cars have top speedometer readings of 85, 110, and 120 mph (an 87 Caravan, 04 Corolla, and 01 Mazda, respectively).
- Cars today are smooth-riding, comfortable, and quiet. They don't shake and rattle, even on moderately rough roads. We drive with the windows closed and the "climate control system" on, winter or summer. So drivers don't feel that they are traveling fast.
- Car magazines promote speed. A typical quote: "Ascertaining a car's flat-out max isn't easy. Factors insignificant at 60, 80, or even 100 mph—the soundness of a car's hardware and the driver's software, aerodynamics, road surface, even local wildlife, for example—can become downright grave as you reach for 200."
- Movies, television, video games, and other media regularly feature speeding cars. The cars sometimes crash, but injuries are rare.

The infrastructure—roads and speed limits—often encourages speeding. Wide, straight subdivision streets posted at 25 or 30 mph and lightly traveled Interstate-quality divided highways posted at 55 reinforce driver perceptions that posted speed limits have little to do with proper driving speeds or safety. As discussed above, speed limits may not describe the maximum safe speed on a road segment and are widely ignored on roads of all types.

Federal actions to reduce speeding

The federal organizations responsible for safety on the roads—the Federal Highway Administration (FHWA) the National Highway Traffic Safety Administration (NHTSA), and the Federal Motor Carrier Safety Administration (FMCSA)—have activities to reduce speeding and speed-related crashes. They developed an interagency speed management strategic plan (U.S. DOT 2005) which promised to increase the priority of controlling speeding and listed activities to support engineering, enforcement, education, research, and cooperation with traffic safety partners. They joined with many partners to sponsor a National Forum on Speeding which produced a detailed action agenda (NHTSA 2005b). They have involved the states through activities including demonstrations of the impacts of setting and enforcing "rational speed limits" and speed management workshops. They have developed new communications messages such as "Obey the Signs or Pay the Fines."

However, these activities to date have promised more than they have delivered. Speeding remains a poor third in priority order behind reducing drunk driving and increasing safety belt use. There have been no major FHWA or NHTSA initiatives to control speeding, nor has Congress given the federal agencies adequate resources to address the problem. One key number tells the story. The SAFETEA-LU highway reauthorization bill contains $29 million for national advertising to support drunk driving and safety belt use campaigns. It contains not one penny for media to support actions to reduce speeding. The federal response seems to mimic the national feeling that speeding is a traffic safety problem in the abstract, but it's not at the top of the list.

How to change the speeding culture (and reduce speeding)

Changing cultural values is difficult, but far from impossible. Many cultural values change sooner or later. Americans have changed their values, norms, beliefs, and behaviors on several health and safety issues in recent years, sometimes for the better, sometimes not:

- Smoking was common a generation ago; now it's marginalized, with most public areas smoke free.
- Eating high-fat foods was common until public health studies about the epidemic of obesity caused a growing interest in healthier lifestyles. Food manufacturers contributed to the changed public attitudes because they found that marketing healthier foods was profitable.
- Recycling was limited to a cadre of concerned environmentalists until municipal governments found that it was in their economic interest to recycle. Recycling is now widely accepted.
- Twenty years ago, we had little concern about terrorists; today we routinely accept screening our baggage, taking off our shoes, and not bringing small amounts of liquid onto an airplane.

Similar changes have occurred on traffic safety issues:

- In 1955, safety belts didn't exist; in 1975, the national safety belt use rate was 10–15%; in 1990, it was about 50%; today it's 82%.
- Child safety seat use has increased even more dramatically, from zero in 1965 to well over 90% today.
- The proportion of drivers in fatal crashes who had been drinking dropped from 41% in 1982 to 24% in 2005.
- Twenty years ago, drivers didn't use cell phones; in 2006, 6% of all drivers on the road at any time were talking on a handheld cell phone.

What's needed to change the speeding culture in the right direction? What's needed to make change happen quickly rather than just watching change happen slowly? Two things, acting together: effective campaigns to eliminate speeding in specific locations and situations where public support already exists and can be increased and vigorous leadership at all levels—local, state, and national—to make reducing speeding a high traffic safety priority. Leadership will bring resources; effective campaigns will raise public awareness of speeding and will increase public support for expanding speeding control more broadly. It's a simple strategy: start with tightly focused targets; apply known methods to these targets to reduce speeds and crashes; publicize these successes and build on them to expand speeding control more broadly.

Local action: Where to start—speeding control targets

Targets can be chosen by road location and type or by driver actions.

Locations

Most people want to control speeding on the street where they live (a reflection of the "not in my back yard" attitude). Most cities, towns, and villages can identify streets where speeding is a problem and where enough citizens will support aggressive speeding control. Specific targets may include school zones; streets with many young children, elderly residents, or heavy pedestrian crossing traffic; high crash locations; or work zones. At these locations, there should be broad support for enforcing the speed limit with very little tolerance; for example, for issuing citations at 2 or 3 mph above the speed limit.

Drivers

Most people want to control the "extreme speeders" who go whizzing by them (it's the other guy who's a danger, not me). Defining these extreme speeders more precisely depends on a road segment's travel speeds, not on its posted speed limit. They may be the drivers in the top 5% of speeds, or those driving 10 mph faster than the average speed. A travel speed survey will provide the data to define extreme speeders in a way that wins broad public support for aggressive enforcement. These extreme speeders are aggressive drivers, and there's broad public support for aggressive enforcement to control them.

Both methods could be combined to target extreme speeders, appropriately defined, in specific locations: perhaps those exceeding the posted limit by 10 mph in school zones during school hours.

Targets to avoid

The right targets are those that make sense and have broad public support. Speed enforcement programs should avoid targets that are too broad or not well defined, such as all drivers exceeding the posted limit on a road, or all drivers who exceed some unannounced tolerance level above the speed limit. The public probably won't understand such a strategy; if they do, they probably won't believe it. Another target to avoid is a road where many drivers exceed the posted limit but where speeding hasn't produced crashes or injuries, unless there is very strong public support for reducing speeds on this road. For example, enforcement programs shouldn't concentrate resources on Interstates without a truly compelling reason. Many drivers on Interstates exceed the posted limit, but fewer than one-sixth of all speed-related fatalities nationwide occur on Interstates.

Local action: What to do—speeding control methods

The steps are straightforward.

1. Choose targets carefully. Be sure the targets have public support. Consider public involvement in choosing the targets. Aggressive drivers may be the best initial target.
2. Set and publicize clear, understandable goals. Make sure they focus on reducing speeding and crashes, not issuing speeding tickets or generating fine revenue.
3. Choose speeding control and enforcement methods equally carefully. Be sure the methods will be able to realize the goals. Regular enforcement, special patrols, and automated enforcement each may have a role.
4. Inform, educate, and publicize. Communications should be an integral part of the program design from the beginning, not an add-on at the end. The right message can be critical.
5. Evaluate and publicize the results. Compare speeds and crashes before and after; compare target and nontarget situations.
6. Evaluate the program. What parts worked best? What could be improved?
7. Expand to other areas. Build on the successes.

Local action: Automated enforcement

Automated enforcement using speed cameras probably will be an important component of a successful speed management program. No jurisdiction has enough police resources to cite speeders all the time on even the highest priority roads. Speed cameras can be there 24/7.

It's even more critical that speed camera enforcement programs follow the seven steps outlined above. Speed camera programs also must ensure that they are designed to be fair and open to the driving public, sensitive to concerns regarding privacy, and are led and managed by law enforcement, not by equipment vendors.

Jurisdictions where the public may not be ready to accept speed cameras may wish to use red light running cameras first. Red light runners are easy to identify and pose a clear danger to other drivers and pedestrians. Public support for red light cameras may well be stronger than for speed cameras. As of July 2006, red light cameras were used in more than 100 communities in 21 states and the District of Columbia. Several summary reviews conclude that they reduce overall injury crashes by as much as 25%, though they may increase low-severity rear-end crashes (Hedlund 2006, Sec. 3.2.2).

Two recent examples show how speed cameras can be an integral part of a targeted speed management program.

Arizona highway 101 forms a semicircle around Phoenix to the north. It's a multilane divided highway, carrying 127,000–170,000 vehicles daily, with a 65 mph speed limit. In free-flowing traffic outside of rush hours, the median speed in 2005 was 76 mph, with a significant number of vehicles exceeding 90 mph. The public was concerned: 76% supported a speeding control

program using speed cameras. Speed cameras had been used in the Phoenix area for over 10 years, but not on a 65 mph multilane highway.

Six cameras, set to photograph vehicles traveling over 76 mph, were installed on a 7-mile segment of highway 101. The cameras began operation in February 2006, to heavy publicity. As of September 12, 2006, 72,300 speeders had been ticketed and the proportion of drivers exceeding 76 mph had dropped from 50% to 0.5%. Speeds also dropped on other sections of highway 101 that had no cameras. The speed cameras are widely supported by the public, not just in the Phoenix area but statewide. Revenue from speeding fines has more than paid operating costs over this period. An evaluation of the effects on crashes is scheduled to be completed early in 2007 (Hegarty 2006).

Illinois work zones are the only location in the state where speed cameras are authorized, and they can be used only when workers are present. The cameras are located on vans that can be moved from work zone to work zone. They are advertised heavily in advance of the work zone with large signs: "Speed Photo Enforced"—the goal is to slow down traffic in work zones, not to issue tickets. In 2006, these speed camera vans were used successfully in six work zones on Interstate-quality highways around the state, supplemented by officers at the roadside and on motorcycles (Tobias 2006).

Local action: Three key points

1. Work with law enforcement every step of the way, from planning to evaluation. In addition to being the ones on the front lines, who make or break any speed control program, police understand what will work and what won't.
2. Let the data drive the program. Go where the crashes are and where the public is concerned about speed.
3. Remember that speed enforcement in general and speed cameras in particular will succeed only if they are used to reduce crashes, not to raise revenue.

State action: Speed limits, enforcement, communications, sanctions, and data

These state responsibilities support and complement local speed control initiatives.

Speed limits

States establish the general speed limits that apply to all roads in a class within the state. States also control the efforts of communities to establish speed zones to modify these general speed limits. This control provides some consistency in speed zone practices throughout the state. But it also may raise substantial obstacles to speed zone proposals, even when they are broadly supported. States should move beyond a rigid application of the 85th percentile rule in setting

speed limits and establishing speed zones. States may wish to consider establishing and enforcing variable speed limits, which can adapt to weather and traffic flow conditions, on key high-volume road segments.

Speed enforcement and communications

States are responsible for speed enforcement on some roads and share responsibility with communities on other roads. States and communities should work cooperatively to develop and implement consistent speeding control targets and enforcement strategies. All states should permit automated enforcement using speed cameras and should encourage and support communities in using automated enforcement in appropriate situations. Effective communications at both state and community levels must set the stage by raising public awareness of the costs of speeding and by vigorously publicizing speeding enforcement activities.

Sanctions

States establish the penalties for speeding violations. They usually include fines and driver's license points, with additional penalties when license point totals become large. Many states increase the penalties for speeding in some situations, such as school or work zones. Many states also increase the penalties for substantially exceeding the speed limit. States may wish to review their speeding penalties and consider how effective they are in deterring speeders. Perhaps stiffer or more creative penalties would convince speeders to slow down.

Data

Data are needed to document the true role of speeding on the highways and in crashes. States need good data to monitor travel speeds, document the true role of speeding in crashes, and identify speeding control targets. Having consistent data statewide will help states develop consistent speeding control programs and communications.

National leadership: Federal roles

States and communities can control speeding only in their jurisdictions. It's hard to change the national speeding culture just through local action, especially since all states and communities can't be expected to embrace speeding control with the same enthusiasm. The U.S. Department of Transportation and its agencies responsible for controlling speed—FHWA, NHTSA, and FM-CSA—must provide aggressive national leadership to help states and communities by making speeding control a national priority and by providing funding, data, research, and communications.

National priority

Speeding control must be as important on the national traffic safety agenda as reducing drunk driving or increasing safety belt use. And it should be: speeding control can prevent more crashes and injuries. Speeding control will be a national priority when it's emphasized in speeches as frequently and vigorously and when it receives as much staff support and program funds as drunk driving or belt use. This national priority should include active and positive support for automated enforcement using speed cameras in selected locations, which is part of the Department of Transportation's plan (U.S. DOT 2005, Objective 4, Strategy 3)

Program funds

Congress should support state speeding enforcement efforts with federal funding appropriate to speeding's national traffic safety priority and also should fund a national speeding communications campaign similar to the national drunk driving and safety belt use campaigns. NHTSA and FHWA should support speeding control to the extent possible given competing highway safety priorities. It's not too early to begin thinking about the next highway reauthorization bill that will replace SAFETEA-LU. It should include additional funding for both federal and state activities to control speeding.

Communications

Cultural change could be led by effective communications with consistent and persuasive messages. The federal agencies should develop a true national speed control campaign, from marketing research through message development and testing to production, placement, and evaluation. State and communities should not need to do all this on their own and may lack the resources to do it well. Good communications are critical to establishing speeding control as a national priority.

Data

While states have the lead in collecting data on travel speeds and speed-related crashes, federal agencies should provide guidance and assistance and should aggregate and report these data to document the effects of speeding nationwide. Travel speed data have not been collected and reported consistently since the repeal of the National Maximum Speed Limit. FHWA should take the lead in documenting where travel speed data are collected, developing a system to aggregate and report these data, determining what additional travel speed data are needed, and helping states and communities acquire these data. Police accident reports do not contain accurate data on vehicle pre-crash travel speeds, only estimates that the police obtain from witness reports, crash reconstructions, and other sources. NHTSA should take the lead in developing practical methods to improve speed estimates for vehicles in crashes.

Research

Research is needed in several key areas, including:

- Develop criteria for setting appropriate speed limits that go beyond automatic application of the 85th percentile rule in every situation.

- Investigate methods for designing "self-enforcing roads" in which the road design itself promotes safe speeds.
- Study engineering methods for achieving appropriate speeds on curves.
- Evaluate the effects of automated speed enforcement in different settings.
- Study and evaluate how to establish and enforce variable speed limits and the effects of variable speed limits on speeds, crashes, and casualties.

Many of these activities are on the Department of Transportation's long-range plan (U.S. DOT 2005). They should be given high priority.

The federal agencies also can lead and encourage private sector companies and organizations to play their part in controlling speed and helping change the culture of speeding.

National leadership: Private sector roles

Portions of the private sector support or even encourage the current culture of speed. They could, and should, work to change this culture in both small and large ways. A few examples:

- Automobile manufacturers could downplay speed in their promotions and ads. They could build cars with a reasonable maximum speed and a reasonable speedometer limit rather than using an engine and speedometer that can exceed more than twice the maximum posted speed limit in any state.
- Car magazines could restrict high speed coverage and promotion to the place where they belong: the racetrack.
- Television and movies could show the real consequences of speeding in wrecked cars and shattered bodies and lives.
- Insurance companies could provide incentives for drivers who are never cited for speeding.
- Trucking companies could reward drivers for not speeding and should consider speed governors for some commercial vehicles.
- University civil engineering courses could emphasize speed management techniques such design principles for self-enforcing roads and rational methods for setting speed limits.

In the long run: Design and build roads with self-enforcing speed limits

Roadway design and engineering are the fundamental determinants of travel speeds. If a roadway is designed for high speeds—a multilane, divided, limited-access highway with few hills or curves—then it's almost impossible for enforcement and education measures to control speeds. On the other hand, speeds on a narrow, two-lane, winding village street will be low. Both short-term and long-term roadway design and engineering strategies can be used to manage travel speeds, as is done in some European countries (NHTSA 2005b).

Short-term engineering measures can include:

- Speed humps or roundabouts on local streets
- Transitional signing at speed zone boundaries
- Pavement markings and roadside elements to provide visual cues that encourage slower speeds
- Better signal timing, to convince drivers that they will keep moving if they drive at or under the speed limit, while speeding only gets them to the next red light faster (a win-win design, since safe speeds equate to faster travel times); perhaps changing signal timing on weekends and evenings.

Longer-term measures should be based on designing roadways with safe speeds in mind from the outset, rather than attempting to manage speeds once the roadway is built.

Summary and recommendations

The speeding culture is so pervasive that it won't be changed easily and probably won't be changed quickly. But it can be changed, it should be changed, and with effective community campaigns and strong leadership at all levels it will be changed. To get started:

Federal agencies should:

- Make speeding control a national priority. Use national leadership to inform public, private sector, and policymakers of the costs of speeding and the need for speeding control.
- Request funding, appropriate to the role of speeding in traffic injuries and fatalities, in the next highway reauthorization bill.
- Encourage states and communities to use automated enforcement as appropriate.
- Develop effective communications on speeding control for states and communities.
- Encourage private sector activities to change the speeding culture.
- Give high priority to the data and research needed to support speeding control.

States and communities should:

- Implement speeding control programs in selected target areas, using automated enforcement as appropriate; aggressive drivers may be the best initial target.
- Build these programs on good data documenting the role of speeding on the highways and in crashes.
- Evaluate and publicize the results and expand to other targets.

Private sector companies and organizations should:

- Evaluate how their activities and communications may support or even encourage the speeding culture.
- Find opportunities to use their activities and communications to discourage speeding.

Speeding can be controlled and reduced. Speeding reductions will bring real results: a 5% reduction in speeds, say from 40 mph to 38 mph on a local street with a speeding problem, will reduce crashes by about 10%, serious injury crashes by about 14%, and fatal crashes by about 19%. With strong leadership and effective community campaigns, these speeding reductions are possible. Without them we can only expect speeding crashes, injuries, and fatalities to increase as the speeding culture continues its hold on America's drivers and roads.

References

Aarts, L. and I. van Schagen. 2006. Driving speed and the risk of road crashes: A review. *Accident Analysis and Prevention* 38: 215–24.

Elvik, R. 2005. Speed and road safety: synthesis of evidence from evaluation studies. *Transportation Research Record* 1908:59–69.

GHSA. 2005. *Survey of the states: Speeding.* Washington, DC: Governors Highway Safety Association.

Hedlund, J. 2006. Countermeasures that work. *Chapter 3: Aggressive Driving and Speeding*. DOT HS 809 980. Washington DC: National Highway Traffic Safety Administration.

Hegarty, M. 2006. *Photo enforcement: Scottsdale pilot project, Loop 101*. Presentation at 2006 GHSA Annual Meeting.

IIHS. 2006a. *Automated enforcement laws*. Arlington, VA: Insurance Institute for Highway Safety.

———. 2006b. *Communities with speed cameras as of October 2006*. Arlington, VA: Insurance Institute for Highway Safety.

NHTSA. 2005a. *Traffic safety facts 2004*. DOT HS 809 919. Washington, DC: National Highway Traffic Safety Administration.

———. 2005b. *National forum on speeding: Strategies for reducing speed-related fatalities and injuries*. DOT HS 809 963. Washington, DC: National Highway Traffic Safety Administration.

———. 2006. *Traffic safety facts: Speeding*. DOT HS 810 629. Washington DC: National Highway Traffic Safety Administration.

Pilkington, P. and S. Kinra. 2005. Effectiveness of speed cameras in preventing road traffic collisions and related casualties: systematic review. *British Medical Journal* 330:331–4.

Royal, D. 2004. *National survey of speeding and unsafe driving attitudes and behavior: 2002*. DOT HS 809 730. Washington DC: National Highway Traffic Safety Administration.

Tobias, P. 2006. *Work zone photo radar speed enforcement.* Presentation at 2006 GHSA Annual Meeting.

TRB. 1998. *Managing speed: Review of current practice for setting and enforcing speed limits.* Transportation Research Board Special Report 254. Washington DC: National Academy Press.

U.S. DOT. 2005. *Speed management strategic initiative*. Washington, DC: U.S. Department of Transportation Speed Management Team (Federal Highway Administration, Federal Motor Carrier Safety Administration, and National Highway Traffic Safety Administration).

Wilson, C., C. Willis, J. K. Hendrikz, and N. Bellamy. 2006. Speed enforcement detection devices for preventing road traffic injuries. *The Cochrane Database of Systematic Reviews 2006(3)*.

Biographical statements

Barbara Harsha is Executive Director of the Governors Highway Safety Association (GHSA)—the nonprofit organization that represents state highway safety offices. She is responsible for directing the organization's Washington office, providing services to the membership, representing the organization in a variety of capacities including with Congress and the federal agencies, and administering federal grants. Prior to joining GHSA in 1988, Barbara worked for ten years for the National League of Cities, one of the major public interest groups in Washington. She served as a senior policy analyst for the League's transportation committee and later as the Director of Policy Development for the League. Before coming to Washington, she was a transportation planner with the Southern California Association of Governments in Los Angeles. She has a masters degree in urban planning from the University of Southern California and a BA from Washington University in St. Louis.

James Hedlund is a consultant on traffic safety research, management, and policy issues under the nom de plume of Highway Safety North. He retired in 1997 as Associate Administrator for Traffic Safety Programs of the National Highway Traffic Safety Administration (NHTSA). In previous NHTSA positions, he directed the Office of Alcohol and State Programs, Office of Driver and Pedestrian Research, and Mathematical Analysis Division. He has written over 40 research reports, conference summaries, research syntheses, and guides for traffic safety practitioners on a variety of behavioral traffic safety subjects. He holds a PhD in mathematics from the University of Michigan. Before joining NHTSA, he taught mathematics and statistics at the University of Massachusetts (Amherst) and at Smith College.

Aspects of meaning and relevance in news media coverage of motor vehicle accidents

John W. Martin and Karen Smith

Southeastern Institute of Research

Monica Worth

Worth Associates, Inc.

Overview

Day after day, rush hour after rush hour, stories of injury and death on the roadway pour forth from the local news. A mother of four, a teenage athlete, a father, a wife, an innocent child. The noble cause in which these tragic victims are engaged? A trip to the grocery store, a family vacation, a daily commute.

Reports of terror threats and other crimes generate visceral responses and increase public demand for immediate solutions. Yet, tens of thousands of vehicular tragedies go unreported, and those that are produce little impetus for change.

Why isn't the public more appalled? Why don't daily news reports fuel a national resolve to "bear any burden, pay any price" until we can all but eradicate one of the most insidious threats to personal security in our own communities?

To answer these questions, it would be wise to begin with an examination of how and why traffic safety information is collected and conveyed by professional news gatherers.

Two elements drive news coverage of any topic: the message and the messenger. In the case of traffic accidents, the relative dangers of auto mobility lurk just below the surface of both, but rarely coalesce and rise to improve the context and penetration of news reports.

In a world overwhelmed by information, how can news media messages and their stewards break through that barrier and compel us to sit up and take notice? Much depends upon a story's meaning and relevance to our own lives. Improving these qualities of communication requires a thorough knowledge of a complex arena and some means with which to reach its gatekeepers and, ultimately, penetrate its veils of objectivity.

Where we begin

Most of us get much of our information about threats to our personal security from news reports. This makes reporters and editors our partners in public safety, and vital allies in any effort to achieve a culture of zero tolerance for traffic fatalities. Yet the role of the media in bringing the risk of death by motor vehicle into sufficient context has been underexplored by scientists and other stakeholders in traffic safety. That the public has not demanded solutions may reflect the

facts that the messages we receive do not convey the totality of this reality and that people do not accurately perceive their own level of risk.

Motor-vehicle crashes cause 42,636 deaths and almost 2.8 million injuries each year (National Highway Traffic Safety Administration [NHTSA] 2006). Among people between the ages of 4 and 34, motor-vehicle crashes are the leading cause of death. They rank third in terms of the number of years of life lost (Subramanian 2006). In addition to the people who are killed and injured in these incidents, the economic costs of our failure to manage traffic safety are huge. The annual tally to our economy of vehicle crashes for 2004 was estimated to be over $230 billion (NHTSA 2006).

The frustrating truth behind these unacceptable numbers is that vehicle accidents are a common occurrence. And, in the news business, decisions are driven by the central question: "What's new?" How do we transform what has sunk into our consciousness as an acceptable fact of life into a new and compelling force for change? In communications terms, we stimulate a new reaction by infusing raw, unaffiliated information with context and relevance, thereby enhancing our ability to grasp its true meaning.

> *Imagine that two fully loaded 747s crashed in every state every year—that's almost ten airline crashes on U.S. soil every month—the equivalent of 43,000 deaths. How long would the American people stand for such terror and destruction? How many months would pass before politicians reached for the media microphone to announce immediate action and investigative reporters pounced on every overlooked opportunity to save lives?*
>
> *If we offer a yellow or even red alert for possible terrorist attacks, can we draw similar public attention to the more pervasive threat of vehicular carnage by sharing analogous intelligence—trends, patterns and other cumulative factors—at critical incident windows, such as a typical Memorial Day weekend?*

We've all heard the infamous statement about what makes an event most newsworthy: "If it bleeds, it leads." Clearly, however, "size" matters in the ability to move a nation to its feet. We know how big the problem is, in terms of hard numbers. What we have yet to learn is how to deliver that basic information with a velocity that sweeps us toward a zero-tolerance safety culture.

What we do

It has long been debated whether the news media shapes public attitudes or reflects public interest. Which comes first, in terms of news judgment: the raw information or the cultural demand and context? If news editors effectively steward information, does that mean the safety community hasn't effectively accessed the news media?

In short, we're not sure. Research linking news media and the traffic safety arena is fairly limited. But based on experience in other fields, we know that product recalls, often publicized by the news media, generally produce a desired safety response. Media reports of health findings, drug side effects and the spread of disease are significant drivers of change in individual behavior, sometimes going so far as to make or destroy markets by altering perceptions of brand

or product trust and safety. And crime reports impact feelings of safety and can change behavior, even inhibiting tourism, shopping, and enjoyment of other liberties.

In one pointed example of the power of "news" to affect our perception of vulnerability, *The Washington Post* reported in an August 27, 2006 article on parental concerns about child safety that, while a little over a hundred of more than a quarter million kidnappings of children annually involve abductions by someone unknown to the child, "high-profile cases of abduction by a stranger have sowed fear, especially since cable TV and 24-hour news have made the details easier to disseminate." The article went on to say that one expert "calls such fears an example of 'moral panic'—a collective fear fueled by the mass media until it becomes self-perpetuating." The article details extreme measures routinely adopted by today's parents to monitor their children's playtime activities and severely restrict their movement in the face of a perceived threat of strangers in their midst.

Clearly, context, relevancy, and meaning are a continuing challenge in the delivery of public safety information. Because the dangers of roadway mobility are far more clear and present than many other types of threats, why haven't news reports of vehicular death and injury inspired more "collective fear" or, better yet, collective action?

To find out, we must gain a deeper understanding of what drives traffic safety news. We can begin by examining recent research findings that relate to media coverage of vehicle crashes. From there we can start to fill in the information gaps, building an avenue of research through which to more thoroughly quantify and analyze the information news media routinely provide. With that data in hand, we can explore with news professionals the realities behind the reports—the factors that govern the tone, type, and volume of news coverage devoted to traffic safety. Such feedback will not only help the safety community hone its delivery. It should clarify what could be done within the bounds of journalistic integrity to lower the societal "pain threshold" and engender a more realistic response to our level of vulnerability.

The objective of this paper is to describe a process through which we can gain these insights and help fuel a mobile nation's mindset for safety.

What we know

Much has been said about the role of "the media" in influencing public opinion. If we want to find out how to pierce the veil of resistance to the down-home facts about roadway safety, however, we need to concentrate, not on the media at large, but on that primary group of information "first responders," the *news* media.

Understanding how the news media report traffic crashes can contribute to a greater understanding the role it plays in reducing risks for drivers. Although research in this area is limited, Connor and Wesolowski (2004) provide an interesting snapshot of newspaper reporting on fatal motor vehicle crashes in four Midwestern cities. Their findings, described below, shed light on the amount of media coverage of fatal crashes, as well as the way the stories are conveyed to the public as "news."

During the time period covered by the researchers, 846 crashes were reported in the National Highway Traffic Safety Administration's Fatality Analysis and Reporting System (FARS). Of these crashes, less than one-third were reported to the public. There were other discrepancies

between the data contained in FARS and the actual reporting of crashes. For example, stories on teen drivers and alcohol-related crashes tended to be overreported by the newspapers, whereas poor road conditions, whether or not occupants were wearing safety belts, and fatal crashes themselves tended to be underreported.

So, what impact do such reporting practices and biases have on our safety culture? In terms of "consciousness," the way stories are reported may bias the public toward a view that "*it just won't happen to me.*" Middle-aged adults who don't drink and drive may believe that they are insulated or protected against being involved in a fatal crash by their own self-image and by society's positive reinforcement of responsible driving behavior. Overemphasis on sensational aspects of risky behavior, coupled with a lack of emphasis on road conditions and safety belt use may make people feel that some factors are more important than others, despite evidence to the contrary.

The result of reporting that does not accurately reflect true public risks may be that the average motorist does not receive a clear idea what kind of people are involved in crashes or what factors cause them. In this way, the risk that people see may be disproportionate to actual statistical risk probability. Drivers may see increased risk for some behaviors and less risk for others when just the opposite could be true.

Another interesting finding of the Connor and Wesolowski (2004) study was the way in which newspapers conveyed stories of fatal crashes. A vast majority of the stories assigned blame to one of the drivers, who was portrayed as a villain, someone who had done something wrong with catastrophic consequences. In this way, newspaper reporting may increase the public's feeling that crashes are largely unavoidable events. If a careless driver is on the road, there is little one can do to protect oneself. In reality, this is not always the case. Road conditions reported in FARS during the study period were labeled poor in more than 20% of the incidents. Road conditions were actually reported in only 6% of the newspaper accounts, however. It's easy to see that taking additional safety measures under poor road conditions is something the public can do to protect itself, but this simple message may not penetrate current coverage.

Finally, newspaper reports used the terms crash and accident interchangeably, again perhaps contributing to the public's belief in any number of cases that "accidents happen" and that there is little or nothing that can be done to prevent them.

It appears that what we do and what we know can be better integrated to greatly enhance the penetration of vital roadway safety information. Thus, we have identified an achievable objective. A first step toward that objective is simple: we can adapt what is essentially a common business communications tool and use it to shine light into the mysterious corners of the roadway safety "umbrage gap."

What we can do

"What we have here is a failure to communicate." This memorable line from *Cool Hand Luke* sums up a common problem for social causes like "traffic safety." Managing the relationship with each "public" that can affect a desired outcome is a fundamental principle of modern public

relations, and thus, of effective large-scale communication. Understanding how each public receives and responds to various types of information is a fundamental step in that direction.

The process of collecting and analyzing data that sheds light on this public interaction is known as a communications audit—a tool that can be used to great effect in studying the path to creation of a safety culture. An audit focuses attention on one or more audiences that have been identified as stakeholders in a desired outcome and studies what is currently at play in that relationship and what can be done to enhance its mutual benefit. Various communications factors are examined and recommendations to fine tune and improve the quality of communication are developed.

While a full audit should be carefully designed to address specific outputs, it isn't hard to envision how such an exercise might be conducted within the relationship between traffic safety advocates and the news media.

The logical first step is to search for existing research on how news organizations cover traffic safety topics. This helps define the platform of available resources—allowing us to further evaluate what we know now. A literature or "clippings" search predicated on carefully identified roadway accident reporting language (conducted with the aid of a reputable media monitoring vendor) is another early step that will produce building blocks for story analysis. The literature search can also elicit an index of terms used to convey fatal crash details, and their general frequency, which can then be analyzed for urgency, gravitas, and other attention-getting qualities.

From there, a representative sample of news stories can be selected, at which point it is possible to measure the editorial weight of messages, the message content (the extent to which reports carry "pure facts" or may be impacted by editorial slants), fact content (which facts are used to tell the story), and the tone of what is communicated (whether positive, neutral, or negative), among other factors.

The assessment can also expand to a national level the existing regional research sample that indicates how accident reportage stacks up beside actual crash data. This might be accomplished by focusing special attention on a series of metropolitan area test markets where key communications variables can be formally tested.

Interviews with news professionals then provide vital, real-world context. Structured conversations with editors and reporters—both the news correspondents who generate individual stories and the traffic reporters who provide more logistical information—are an essential audit component that can help to illuminate motives, vision, awareness, and editorial priorities involved in crash reporting. Practitioners might also shed light on standard procedures that prove to be a target for improvements: how often and under what circumstances such events are covered on-site, what information is accessible to crews involved in typical one-off, hastily assembled incident coverage, what elements prompt expanded coverage, and whether or not current resources can provide sufficient contextual data to meet daily demands and editorial standards.

It may also prove worthwhile to research how many reporters in the nation cover a dedicated transportation "beat." For the vast majority who cover accidents as part of a bigger territory, it may be useful to know their main area of focus (Metro news? Crime? General assignment?).

Another element of the assessment can be how fatal crashes, in particular, are reported by all primary stakeholders and how jurisdiction operates in this context. Are roadway fatalities assumed to be the bailiwick of law enforcement, transportation agencies, or other entities and

how does communication flow among stakeholders? A brief, mini-audit of "internal" stakeholder communications, similar to that performed on the broader level, will shed light on the number of data resources available, their perspectives, and their connectivity.

The communications audit should include some method of quantifying and qualifying the information resources currently being provided to editors, producers, and correspondents by roadway safety groups, including the messages conveyed. The goal here is to assess how the "roadway safety industry"—transportation and highway departments, agencies, and associations—currently advances to these critical messengers both core information (trends, statistics, studies) and broader concepts. A beneficial product of this analysis is a detailed inventory and assessment of the types of messages now being disseminated.

Astute analysis and presentation of these and other auditable components of the daily drumbeat of death by motor vehicle should prove informative, not only to the roadway safety community, but to the news media itself. Public affairs practitioners know well the two-way street of surveys and polling: the opportunity to educate, enlighten, and motivate an audience, while engaging it for the purpose of gathering input.

The good news is that, considering the cost of modern public information campaigns and the breadth of the local and national audiences to which safety organizations can gain daily access via the news media, the time and cost of this process are relatively small. A complete communications audit of a representative sample of news organizations and news markets can be completed in as little as six months at a cost ranging from $75,000 to $300,000, depending upon the size of the sample chosen. Studying three markets with a cumulative population of 3,000,000 people, at an estimated cost of $300,000, produces a $10 per person investment—and breaks new ground in the delivery of essential, life-saving messages. Leveraging that investment into more effective communication nationwide reduces the cost per impression to a matter of pennies, while chipping away at one of America's most preventable causes of death and injury, not to mention an economic cost to society now estimated at more than $200 billion per year.

Summary

Motor vehicle related injury and death are the nation's leading public health problems. Yet, despite abundant evidence of the risks involved in vehicle operation—and a considerable body of ready remedies—we tolerate an alarming status quo and, daily, slide behind the wheel to play a deadly game of "beat the odds."

A relatively brief and cost-effective audit of the news media's role in communicating the reality of roadway mobility will shine a spotlight on areas in which our conversation with the motoring public can be advanced while encouraging improvements in the context, relevance, and meaning of news stories on the topic.

A communications audit is a systematic process of evaluating what messages are going out, to what extent they are being received, how they are being received, the lasting impressions they leave with target audiences, and the overall impact they create—whether or not they are delivering the change we seek. Based on gaps identified in this process, stakeholders can formulate

strategic communication plans that make existing resources work harder to further their desired outcome.

This process can be put to work for a change in America's roadway safety culture. Before other steps are taken to create change, a comprehensive communications audit can assess how the news media impact America's current safety culture. An audit will offer insights into the ways traffic accidents are reported while stimulating thinking among editors and reporters as to their role, responsibilities, and resources in the public safety equation. The result will be timely information for existing stakeholders in the highway safety community that can significantly improve communications strategy and effectiveness.

The bottom line: If getting into an automobile and driving is, in fact, the most unsafe thing an individual can do in any day, can—and should—media reporting be designed to penetrate resistance to the facts and feature positive reinforcement of a mindset for safety? The highway safety community has within its reach a tool with which to dig for answers to this question, and an opportunity to transform the ore that tool uncovers into an information support structure for a new American culture of roadway safety.

References

Bahrampour, Tara. 2006. *Discovering A World Beyond the Front Yard/Some Parents Defy Trends, Allow Kids to Roam Unsupervised*. The Washington Post (August 27, 2006).

Connor, S. M., and K. Wesolowski. 2004. Newspaper framing of fatal motor vehicle crashes in four Midwestern cities in the United States, 1999–2000. *Injury Prevention* 10:149–53.

Subramanian, R. 2006. *Motor vehicle crashes as a leading cause of death in the United States, 2003*. National Highway Traffic Safety Administration's National Center for Statistics and Analysis. Traffic Safety Facts Research Note.

Biographical statements

John W. Martin is the President & CEO of SIR. Prior to SIR, John led the marketing and marketing research efforts of PBM Products, a consumer products company specializing in nutritional products. While at PBM, John orchestrated new product launches and promotional programs with leading retailers including Wal-Mart, Target, Kroger, Albertson's, CVS, and dozens of other national chains. During John's tenure as PBM's chief marketing officer, the company became one of the fastest growing private companies in America.

John began his career at a mid-Atlantic advertising agency, where as President he led the agency's planning and research work in healthcare, B2B services, and travel marketing. Many of John's initiatives while at the agency received the American Marketing Association's (AMA) Effie Award, for the most effective marketing campaigns in the country.

John received a master's of business administration from Virginia Commonwealth University in 1984 and graduated from Washington & Lee University with a bachelor's degree in economics in

1982. John is often a featured speaker at marketing workshops around the country and most recently addressed the Southern Newspapers Publishers Association annual conference.

Karen Smith, Ph.D., is SIR's Senior Vice President of Research Strategy. With more than twenty years of experience conducting research for some of the nation's (and the world's) leading corporations and organizations, Karen is responsible for all phases of SIR's research—from problem conceptualization and research design to analysis and strategic interpretation of results. Karen works across a variety of industries, including healthcare, transportation, manufacturing, education, associations, consumer products, business-to-business, and finance.

Monica Worth is Principal of Worth Associates, Inc. Now approaching its 20th anniversary, Worth Associates provides communications and marketing support to national and international clients, working within the federal government, Congress, the media, and at the roots of communities to shape public perceptions of significant issues, organizations, and industries.

Worth Associates' work with key transportation stakeholders from the American Traffic Safety Services Association (ATSSA) to the American Association of State Highway and Transportation Officials (AASHTO) to the U.S. Department of Transportation/FHWA, and allied industries such as emergency services, construction, and energy has provided a consistent level of contact with the nation's leading transportation media, including correspondents with the nation's top 25 major daily newspapers, national print, television, and radio press, and the major trade magazines. Currently, Worth Associates provides communications and marketing counsel to several innovative technology programs at FHWA and AASHTO and manages outreach for programs of ATSSA and the National Partnership for Highway Quality. Worth Associates founded and staffs the Ad Hoc Roadway Public Affairs Committee (AHRPAC), a group of communications directors from major transportation associations and Congressional committees that seeks to improve outreach to motorists on roadway transportation issues.

Monica Worth is the recipient of a 2006 Federal Highway Administration "Partnership in Excellence Award" from Acting Administrator, J. Richard Capka.

Road traffic in the Netherlands:
Relatively safe but not safe enough!

Fred Wegman

SWOV Institute for Road Safety Research
The Netherlands

Introduction

The Netherlands—a small, densely populated country in North Western Europe, about as big as Rhode Island—has a population of about 16 million, nearly 135,000 kilometers of paved roads, and about 7 million cars. It has quite a large number of historical city centers that are centuries old. Recently, a music festival was held in one of them, Utrecht. The performances took place on a boat on a canal, and the audience was spread along the walls on either side. There was a wooden stairway connecting the street to a lower path along the moat. A lot of the audience was standing—watching and listening to the performance; there were so many of them that the stairway came loose from the wall and collapsed. Dozens fell into boats under the stairway and in the moat. Ten of them had to be taken to the hospital, and three of them were severely injured. Since then, one of the three had died in hospital from the injuries incurred.

The people on the stairway assumed that the designer and owner of the stairway had ensured that it was safe to stand on. After all, nobody had been warned beforehand that their safety wasn't guaranteed. After the accident, the question was immediately asked about who was responsible and, thus, to blame. A scapegoat was looked for. Should the visitors have been more careful? Could the organizer of the festival have better guaranteed a safe outcome? Should the owner of the stairway, the city council, have built a safer one or closed it before the performance? Should there be no more stairways or no more festivals? No, we find it very difficult having to accept such drastic solutions: "everything should be allowed" seems to be a sign of the times here. In society there is a fundamental awareness that risks, if there are any, are either controllable or should be.

After such an accident there is usually an "independent inquiry," but I predict that the conclusion will be that the risks were not well known, neither by members of the public, nor by the festival organizer, nor the owner of the stairway; and that rules and regulations had been broken. *The accident need not have happened.* This means, in general, that stricter rules will come, and it will be agreed that their compliance will be better controlled. There will then be notice boards everywhere with "warning" and "danger" on them. The option of "no more stairways or no more festivals" is regarded as socially unacceptable. "Crowds of people are always dangerous, but it nearly always ends well," so why prohibit or even limit them?

Modern Dutch society has a great amount of material certainty, and less welfare is regarded by the overwhelming majority as undesirable. Society feels partly responsible for this, and does not leave the individual completely to his or her own fate. We are not able or willing to do without

economic and welfare growth. However, society needed technological developments to get welfare as high as it is now and needs it to maintain this high level and to raise it even further. Examples are energy supply, data communication, and transport. However, many technological developments generate their own risks, and these risks are indeed regarded as small ones, but they cannot be totally eliminated. They have become smaller in time and can be made even smaller, but a society without risks is practically unimaginable. This raises the question: what is safe enough and how much are we prepared to pay for lower risks?

In this essay, I will delve deeper into this question from the perspective of the safety of road traffic. Can such a lot of road traffic be even safer, and how can it be achieved? It is also interesting to investigate who is responsible for crashes and who bears what responsibility for preventing crashes and casualties. I will answer these questions from a Dutch perspective.

Reduction of traffic risks

It is estimated that every year 1.2 million people are killed in road crashes throughout the world (Peden et al. 2004). The Netherlands belongs to the safest countries in Europe and in the world. Road traffic is relatively safe in the Netherlands.

Over the decades, many highly motorized countries, such as the United States and Western European countries, have seen decreases in the number of road casualties. These reductions are impressive, even more if we take into account the increase in motorization and the kilometers traveled in all of these countries (Table 1).

The greatest reductions in fatalities are observed in this period in Western European countries (almost 60% reduction). After leveling out around the year 2000, a new decreasing trend can be observed the last couple of years. In the United States, there has been a slower decrease than in Europe, and no real progress can be observed the last couple of years (NHTSA 2004). Although the USA has achieved a decrease in fatality rate per distance traveled (a yardstick used in the USA), the reduction of fatalities is far less than in many other highly motorized countries. This probably also applies to the number of injured and amount of material damage. During the last few years, the annual number of road deaths has been about 40,000. It is striking that the USA, in contrast with many other countries, has chosen a ratio to measure road safety development, and not the absolute numbers of deaths and injured. After all, ratios can decline while, simultaneously, the absolute numbers increase—a politically undesirable situation that is also not very easy to explain to the population. In the political debate about this subject in the Netherlands, we have, therefore, opted for absolute numbers. Since the 1980s, we work with quantitative road safety targets which are formally determined by Parliament. The positive numbers in 2004 and 2005, 19% and 7%, respectively, fewer fatalities than the previous year, led the Minister of Transport to announce that she wanted the targets for 2010 and 2020 to be lowered.

The results of Table 1, of course, offer neither a single insight into the reasons why countries differ from each other nor any further insight into explanations for a development in a country nor clues pointing to the policy performance of a country. Analyses are needed to do this. In recent years various attempts have been made (see, for example, Koornstra et al. 2002; Wegman et al. 2005; Johnston 2006).

Table 1. Overview of the reductions in the number of road deaths in the 1970–2004 period for several highly motorized countries. Source: International Road Traffic Accident Database (IRTAD).

Country	Change 1970–2004
Australia	−58%
Japan	−61%
Canada	−46%
United States	−19%
France	−66%
Germany	−73%
Great Britain	−57%
Netherlands	−75%
Spain	−13%
Sweden	−63%
Switzerland	−69%

The developments in the Netherlands are impressive—a reduction of 75% in about 35 years—from more than 3,200 road deaths in 1972 to about 800 in 2005. Until now, we have not been able to completely explain this reduction, only partly. For example, we know that many effective measures have been taken during the past decades (Koornstra et al. 2002). We can illustrate this further by examining the risk development in traffic; very many of the road safety measures try to lower this risk. As in all highly motorized countries, the risk in the Netherlands, expressed in deaths per motor vehicle kilometer, has declined (Figure 1).

This trend shows a general exponential decay, a mean reduction rate per year of about 6.5%, although major deviations from this mean value can be observed. As said, a large number of measures has contributed to this decrease in risk, including the introduction of road safety legislation such as general speed limits and an alcohol limit in the seventies, the extension of the (relatively safe) freeway network and more and better facilities for pedestrians and cyclists (such as traffic calming) and bicycle paths in the seventies and eighties, more and more efficient police enforcement in the 1980s and 1990s. However, there is no all-embracing explanation.

But the idea that more traffic must lead to more casualties is demonstrably incorrect. The idea that the increase in traffic and the decrease in risk is a constant is also incorrect. There is, therefore, no such thing as a predisposition to a number of casualties or to a risk. That is an important observation and is optimistic, even if we are not able to completely explain past successes. Although there is still an increase in exposure to danger, the number of road deaths has declined considerably.

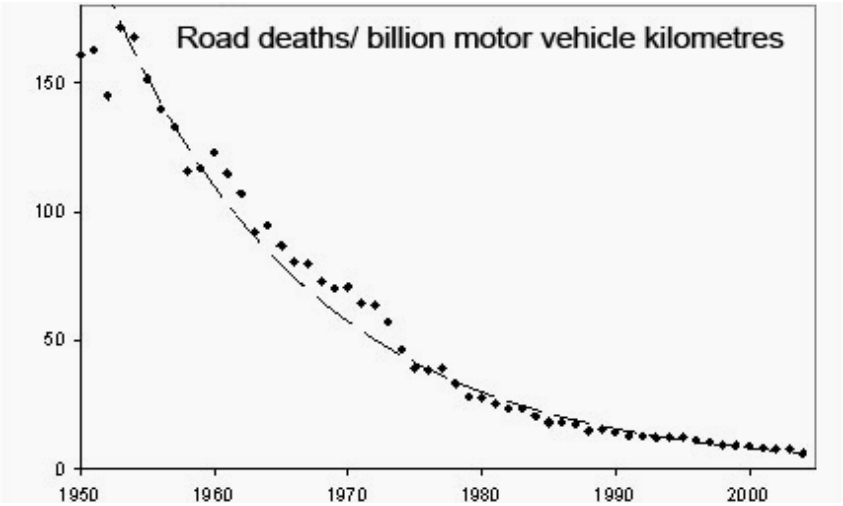


Figure 1. Road deaths per billion motor vehicle kilometers in the Netherlands, 1950–2004. (Source: the knowledge base at www.swov.nl)

In spite of these improvements, we have to make a second important observation—that traffic participation inevitably brings risk. The risks in road traffic are many times greater than in other modes of transport. Further analysis of these risks teaches us that *road traffic is inherently dangerous* (Wegman and Aarts 2006). This means that the road traffic system was not designed with safety in mind, as were railways and aviation. This means in turn that road crashes today are to some extent inevitable and the question is then, how to eliminate dangerous situations in road traffic and thus reduce the chance of crashes, severe injury, and death.

Road traffic without risks?

In modern society, there are many different risks, and hardly any are regarded as acceptable. Risks in road traffic can be objectively compared with other risks, such as natural disasters. When regarded as a national health problem, road-crash injury can be compared with other health threats. Such comparisons invariably teach us that road traffic involves relatively great risks. Somebody once reasoned that the present status quo would be a good indication of the acceptance of risks in society; otherwise, society would do something about it. This reasoning does not make sense if we see which political statements are made in many countries. For example, the European Union has the ambition to halve the number of road deaths in ten years—2000–2010 (European Commission 2001). The problem is much more a matter of how to lower risks and at what price.

However, as already mentioned, a modern society without risks is difficult to imagine. That is why the moral goal of “zero fatalities” as in Vision Zero in Sweden is a good and, perhaps, the only correct starting point. However, the pressing question remains: what is sufficiently safe? My opinion is that a society will never accept the current level as long as there are possibilities, even utopian, of lowering the risks and decreasing the number of casualties. In previous publications we have called it the principle of *avoidable crashes* (Wegman 2000). This principle goes as

follows: if crash causes are known and we know that they can be eliminated via cost-beneficial investments, then there are indeed avoidable crashes. So long as such crashes occur, there is social pressure to avoid them, or this pressure to prevent avoidable crashes can be created. One of the most important roles for social organizations, such as consumer organizations and automobile clubs, is to make clear that avoidable crashes occur and to win social support to prevent such crashes. If many citizens are not aware of the risks or of the fact that risks lead inevitably to avoidable crashes, then it's their job to make them aware of it. Research has shown that, when asked, (Norwegian) citizens have a good sense of risks and risk differences (Elvik and Bjørnskau 2005).

If you look at the large risk differences between the transport modes, the question is raised as to why society just passes these differences by with a shrug. For example, aviation is (by a factor of almost 30) safer per distance traveled than road traffic (ETSC 2003), and that a kilometer on a motorbike in the Netherlands is 15 times more dangerous than in a car. Evidently, the ratio does not rule here, and objectively talking about the risks is not the whole story. Not all risks are the same, and this also applies to casualties and crashes.

There is a great deal of knowledge about why people want to take certain risks or actually wish to avoid them. Examples are: voluntary vs. involuntary risks, risks you can control yourself or leave to a professional, one disaster with many casualties vs. many crashes with one victim per incident, the price you have to pay for not having to take risks, etc. There is more at hand than only the objective risk; there is also a moral and often also an emotional value of a risk. Seen from this perspective, and much less than from a purely rational cost/benefit-based approach, freeways have medians with barriers; nobody may just shoot through the barrier and crash into an "innocent road user." Innocent and vulnerable road users in the traffic mix—children and the elderly, pedestrians, and cyclists—can count on a great deal of sympathy in the Netherlands. Sometimes people speak of this very ideologically, but this certainly does not mean that the other group, i.e., motorized traffic, ranks second. There are two important factors behind this observation: the contribution of motorized traffic to the economy (not only to the economic product of a country, but its contribution to economic growth) and the "acquired right" of practically every citizen to be able to develop socially better via participation in motorized traffic. This concerns the improvement of road safety in general, and of special groups in particular. The result of this ultimately determines, to a great extent, the road safety improvement pace in a country. To weigh all these different interests, political decisions are needed.

Political decisions

Two questions are important for risk management: a) how to set the political priority for road safety compared with other social problems, i.e., to influence the political agenda setting and b) how to assess various, incomparable, and special interests, when reducing risks by certain interventions. Both questions require political decision-making.

In the Netherlands for the last 20 years, we worked with a quantitative road safety target. This target has two aims. First of all, setting road safety promotion as a political priority. Such a priority means that road safety is carefully weighed against other priorities. Second, it is necessary that stakeholders, if needed, perform more activities to achieve the target set. In a recent publication, it was made plausible that "the establishment of quantified road safety targets have an appreciable association with an improvement of road safety" (Wong et al. 2006). It is

beyond dispute that political decision making can be influenced by social organizations. In many countries, lobbying has been elevated to an art. Also, research institutes using impartial, scientific-based knowledge can be very influential.

By including the subject of road safety on the political agenda, for example, via a mobilizing quantitative target, it then perhaps becomes a contributory factor in an effective road safety policy but is certainly not a sufficient precondition. In Netherlands politics, road safety is not an issue that separates political parties. All Parliamentary parties treat it as an important issue. For many decades now, all Dutch Governments have been coalitions of two or more political parties, and they have all come to the conclusion that road traffic was not safe enough. What does divide political parties is the rate of improvement and the price to be paid for it. Reducing exposure to danger, e.g., by restricting or excluding certain groups from participation in traffic, is not a popular way of achieving this. To illustrate, Parliament recently rejected a Government proposal to raise the minimum operator age for mopeds from 16 to 17 years.

The limitation of existing individual freedoms or considerable burden increases for citizens and consumers is generally an extremely sensitive matter. The reasoning for this often shows not a great deal of courage; let's first try to achieve our goals with less far-reaching measures. If, in the event that it does not work, then further-reaching measures will be considered; also known here as "the big stick strategy." This reservedness does not apply when punishing individual road users if they, for example, have been found guilty of causing a crash by driving too fast with a much higher Blood Alcohol Content (BAC) than the legal limit of 0.05%, etc. More severe punishments for people causing crashes are discussed regularly in the Dutch Parliament. A main issue in Parliamentary discussions, and discussions in provincial and town councils, is the expected public response to new initiatives.

Public attitudes, opinions, and preferences

As far as Dutch citizens are concerned, road safety is the highest priority within the theme "traffic and transport," and it is considered to be of both societal and personal importance. However, although people see road safety as something that should be given a higher priority by government, this opinion appears to be held somewhat less strongly, as Table 2 illustrates.

The relatively greater risk in road traffic, when compared with other public health threats, does not make much impression on policy makers and opinion leaders. What does impress them are the relatively great risks of vulnerable and innocent road users: children, the elderly, pedestrians, and cyclists. Social organizations such as the Royal Dutch Touring Club ANWB, the Dutch Cyclists' Union, and the Dutch Traffic Safety Association pay a great deal of attention to these groups of road users and, without any doubts, they influence political decision-making on this. Furthermore, what also seems to impress are major road crashes. These crashes get a lot of media coverage, and this media attention not seldom results in preventative action.

Periodically in Europe, a study is carried out in which questions are asked about opinions and attitudes of motorists concerning road safety issues. In the meantime, this study has been carried out three times—in 1991, 1996, and 2002. The results show that, in general, the Dutch motorists support many of the measures taken to improve road safety (Goldenbeld 2003). This means that improving road safety does not involve a struggle with the entire population—at the most, just

some of them. Support has been expressed for further-reaching measures: introduction of a demerit points system, no alcohol *at all* for novice motorists, more police surveillance, etc. There is also a considerably increased interest for new devices in the car such as a navigation system and an alcolock (to prevent drunk driving). A black box that records information about the cause of a crash seems to be getting accepted. There are, of course, other subjects about which the Dutch motorists are doubtful, and the most important of these is the speed limit on freeways. This sort of information is important when preparing policies and when trying to get political support for certain interventions. There are indications that the greater the support for certain measures is, the more probable the spontaneous compliance will be and the less the enforcement burden will be.

Table 2. Percentage of respondents who agree or strongly agree with statement mentioned about the various subjects (2005).

Subject	Of (big) societal importance	Of (big) personal importance	Should get government priority
Road safety	96%	95%	79%
Ignoring traffic rules	92%	87%	80%
Infrastructure maintenance	92%	68%	69%
Punctuality of trains	88%	29%	79%
Travel time	78%	47%	64%

However, even with a rather large amount of support, there is no certainty that every measure can hope for the people's support. In addition, there is nearly always a certain amount of natural skepticism about what the government decides. This means that the quality of policy implementation requires a lot of care and attention. Social organizations are in such matters the voice of mature and well-educated citizens. Policy performance depends on many factors.

Effectiveness of policy performance

A number of general lessons can be learned, based on the general knowledge about the effectiveness of policy performances and, in particular, the contribution towards this policy implementation. In essence, this involves three terms (Glasbergen 1987): *knowing, being able, and wanting*. An implementer must know what is expected from him, one must be able to implement the policy, and want to do so. The "knowing" is a question of communication between commissioner

and implementer. Being able is a matter of: money, time, personnel, and knowledge. Wanting is a matter of (vested) interests, pros and cons for an organization involved in implementation, etc.

These general lessons have been summarized in two checklists (Figure 2 and Figure 3).

The first checklist is related to the contents of policy documents; the second is a checklist related to the implementation itself. These checklists were made more than 25 years ago (Mazmanian and Sabatier 1981) but are still just as relevant. What is surprising is that, apart from a checklist about the implementation itself (Figure 2), there is also a checklist of policy document requirements (Figure 3): a good policy document could increase (the value of) good implementation. Moreover, Mazmanian and Sabatier are of the opinion that, in a democratic system, those elected must support a policy document, then the civil servant organizations and others.

1. Create political support
2. Define goals/objectives/targets precisely
3. Use valid causal theory (problem – solution)
4. Organize enough means (implementation + monitoring)
5. Reduce necessity of inter-organizational decisions
6. Use sanctions/incentives for
   - co-producers
   - target audience
7. All stakeholders should prioritize implementation
8. Encourage active support of stakeholders

Or: organize effective 'delivery mechanisms'

Figure 2. Checklist of the quality of policy implementation.
Source: Mazmanian and Sabatier (1981).

Note that in Figure 3, as many as three of the eight points refer to the support of stakeholders who should be included in the policy document (items 5, 7, and 8). So, these can be considered as core recommendations for a good policy implementation. A policy must, ultimately, be sufficiently clear that the term “effective delivery mechanism” is applicable and the responsibilities for these delivery mechanisms must also be seen to state that—preferably in the policy document itself and not just when it is being implemented (only to discover by then that there is no effective policy implementation at all).

If a policy document has been determined (either a Strategic Plan or an Action Plan), implementation can begin. If we assume that then, as much as possible meets the requirements of Figure 3, it is recommended, from Day 1 on, to keep an eye on things. To do this, the checklist of Figure 2 can be used.

What Figure 2 comes down to is the scanning of a policy context. After all, essential changes can occur in the implementation from the very first day onwards. First of all, policy context means

the monitoring of the economic, social, and political environments. Just as important is the public support for the problems being tackled or the solutions proposed in a road safety program.

A third area of attention is the progress in the policy implementation. The more concrete that the policy plans indicate which countermeasures and activities should be carried out in which period, the easier it is to show the progress. It is also possible to test empirically the assumptions at the base of the policy program. It is possible that during the practical implementation there will be new, unforeseen problems.

A fourth area of attention is the support from the key stakeholders for the implementation. Organizations are also confronted with new realities and adapt to them. Then it can happen that the support already offered disappears, without this being explicitly decided in practice. It is good if those responsible continually inform themselves of the extent to which stakeholders abide by their promised support for implementation.

1. Monitor economical/social/political environment
2. Monitor public support
3. Monitor progress of policy implementation
4. Monitor support of key-stakeholders
5. Monitor quality of 'delivery mechanisms'

Figure 3. Checklist of the quality of a policy document to improve policy implementation. Source: Mazmanian and Sabatier (1981).

Finally, there should be an effective “delivery mechanism” in a road safety action plan. Stakeholders have been allured/provoked or even forced to make their contribution, and assumptions are made as to how to deliver effective and efficient policy performances. Sometimes cofinancing is used as mechanism, sometimes training programs, and sometimes covenants are signed, etc. Here it is also relevant to enquire if and how these “delivery mechanisms” work in practice.

This more theoretical approach about such an important subject as policy implementation was further studied in the SUNflower project (Koornstra et al. 2002). This project compared the policy performances of three countries: Sweden, the United Kingdom, and the Netherlands (the SUN-countries). A number of important conclusions about policy implementation are now presented.

The common and different policy and organizational features in the SUNflower countries

The level of traffic safety of a country is determined to a substantial degree by factors which lie outside the direct influence of its traffic safety policy or by the way those factors can administra-

tively be handled by means of policies. Moreover, these factors might differ substantially for different countries. Both aspects are highly relevant in addressing the "common and different policy and organization features" of the SUN-countries. Such factors concern, for instance, the geography and characteristics of the landscape, the climate and the light conditions, demography and population characteristics, and, of course, the many aspects regarding the mobility and the traffic infrastructure of the three countries. With this previous remark and its implications for comparisons in mind, this section will merely be focused on comparisons of safety policy and safety organization. A more practical remark also to be made in advance is that safety policy and its organization can be addressed from different points of view or on different levels. Here, the hierarchical division of policy and organization into a strategic, a tactical, and an operational level is chosen.

On the *strategic level*, traffic-safety policies in the three countries have much in common. In each safety program, statements can be found that lack of road safety is not an unavoidable side effect of road transport, but that it is the transport system which has to be fundamentally arranged in such a way that people can travel without the harm of fatalities and serious injuries. The implementation of this abstract objective requires its translation into tangible objectives and, in particular, into intermediate targets. Nowadays and for several years, each of the three countries has set quantified targets, monitored these on a regular basis, and—what is more—sharpened the targets over time to reach the eventual objective. The three most recent targets have different apparent fatality-reduction percentages over different periods to 2010, although in fact the British target does not have a separate fatality target. If compared to the actual fatality levels in 2000, and assuming the British target for fatal and serious injuries combined referred directly to fatalities, the targets for 2010 imply different fatality-reduction percentages need to be achieved between 2000 and 2010: for Sweden 32.5%, for Britain 37%, and for the Netherlands 29.5%. The British target appears to be the most difficult to achieve because the trend in fatal injuries shows that substantially less than the target percentage occurred for serious injuries in Britain over recent years. Against the actual target definition, the likelihood of reaching the 2010 target looks much better.

Target setting proved to be a valuable means to get, and to keep, traffic safety on the political agenda (Wong et al. 2006). It is also an efficient managerial tool to define responsibilities for the different levels of administration and among other stakeholders in the field. The actual policies in the three countries also correspond with each other to a great extent. This is expressed by the fact that each contains a set of similar points of specific attention. These points of attention mainly address the same types of problems, for instance: speeding, vulnerable road users, the infrastructure, drinking and driving, and so on—albeit sometimes in a more or less elaborated or intensified way.

Interestingly, however, the safety visions of the three countries differ. In principle, this could have different impacts on the way the safety problem will be handled. And, of course, different approaches might lead to different results. These differences in vision refer to the "Vision Zero" approach in Sweden and the "Sustainable Safety" strategy in the Netherlands on the one hand, and the more problem-oriented and professional practitioner-led approach in Britain on the other hand. Although a shift in the application of certain types of solutions and measures can—at least in the Netherlands—be traced, it is still too early to demonstrate a corresponding difference in the safety profits in practice, when these are detectable at all. And the reason why is obvious.

The actual application of the Sustainable Safety principle in the Netherlands only started in 1998 on a limited budget. This is even more the case for the implementation of the Vision Zero approach in Sweden, operationally starting in 2000. Moreover, a part of the applied Sustainable Safety and Vision Zero measures belong to infrastructural measures that have already traditionally and intensively been used (e.g., roundabouts) in Britain. Stating a difference in safety vision is one matter, but answering the question why this difference has arisen between countries that have so much in common regarding their safety problems and policies is another. A clue might be the fact that achieving the safety target was no longer taken for granted in the Netherlands and Sweden at a certain point in time, while simultaneously it was concluded that some safety problems could not be addressed as before. This situation stimulated a search for a new approach. Possibly, an intensified application of existing measures still offers enough improvement opportunities, as the current British program is aiming to achieve.

On the *tactical level*, we have to deal with the practical means, sometimes expressed as the "toolbox of policymakers." It basically concerns the funding of a safety program, its organizational structure, the planning and decision making, and so on. It also concerns education, information transfer, enforcement, rules and regulations, guidelines, and so on. Enough expertise on such topics is certainly present in the SUN countries, while their organizational structures, although differing, are covering the same topics and expertise. On the tactical level, opportunities to influence mobility and the transport system from a perspective of traffic safety seem to be of more interest. After all, exposure and the conditions under which it occurs, are of major importance for traffic safety. Some clues can be found, but not enough to provide a clear focus in safety programs. Nevertheless, with regard to the Sustainable Safety strategy, indeed attempts are being made in the Netherlands to systematically transfer traffic onto the safer—higher—road types. However, attempts to encourage people to make use of safer transport modes, in particular public transport, are usually a result of lack of road capacity, leading to traffic congestion, etc. This kind of solution is, of course, especially relevant in metropolitan areas. Public support for safety measures is also essential. That public support is of great importance seems to be a lesson learned in each of the three countries. All safety programs refer to it, and in each, there is an attempt to create and foster public support. Different ways are being applied, presumably taking into account national preferences using studies that assess public attitudes.

The *operational level* is concerned with safety actions, (whether or not integrated with other fields of policy making like, for instance, the environment) and about specific measures. It is without a doubt that most well-known types of remedial action have been taken in all of the three countries. Broadly speaking, the only observable difference is, in fact, the timing. In trying to define differences, some account needs to be taken of the scale of application. In a way, the similarities should be expected. Among our "information societies," rapid exchange of knowledge and experience is usual, particularly in cases where we are dealing with the same kind of problems. With respect to this, the importance of road safety research also has to be stressed. Development of new approaches and publication of evaluations of their effectiveness in a scientifically reliable manner has contributed and will significantly contribute to effective safety policies.

In all other countries, it is clear that national, regional, and local governments have played a leading role in improving road safety and that social organizations indeed influence government

decisions. They sometimes even contribute to policy implementation, although this contribution is rather limited. This is also the case in the role the private sector plays. It would then be interesting to examine why the government has played such a central role in improving road safety and to ask ourselves whether the private sector could do more in the future.

Market forces and government

The market force is an important point of departure in modern micro- and welfare-economic theory. There are several reasons why a market can fail. Where investments in road safety are (or should be) made within a market setting, we can simultaneously distinguish numerous forms of market failure involving different stakeholders in a highly complex market. Market failures all have one thing in common: they reduce incentives for road safety investment below a level that would be socially efficient. This provides an economic argument for public intervention into the road safety market.

The diversity in market failure forms in road safety-related markets provides economic justification for the fact that the public sector has long been active in this area. The most important considerations are probably the following:

- The safety of road users can be regarded as a merit good, insofar as road users, for example, cannot assess the actual risk rationally and, thus, they underestimate it. Risk assessment is relevant in various behavioral choices prior to and during road use, such as purchasing a vehicle, purchasing safety devices and facilities, route choice, and executing various types of maneuvers.
- The interaction between road users concerns external costs in the sense that the safety risk inflicted by one road user on another is not reflected in market prices. People are liable for damage inflicted on someone else, but this liability does not cover (completely) all forms of damage, such as intangible damage. This deficiency is reflected in insurance premiums which are based on the payments that an insurance company has to make in crash cases rather than based on actual social costs. Furthermore, while insurance premiums are differentiated in the Netherlands (annual mileage above/below 20,000 kilometers, region, no-claims bonus systems, passenger car or motorcycle), etc., this does not come close to the extent to which damage risks differ between individual road users. This is also the case for the differentiation in premiums within the no-claim bonus system following damage caused and, as such, is a very bad predictor for the future damage risks of the insured person.

- External risk increases with every kilometer driven, which is not taken into account in the insurance premium. Even if all material and intangible damage to others were to be fully incorporated into insurance premiums, this would not result in a correct price per kilometer for the person who causes a crash. In addition, infrastructural safety devices and facilities (safer pavements, public lighting, road signs, roundabouts, etc.) are public goods, as is the infrastructure to which they are often inextricably attached. They are public goods both in a purely economic sense (nonrivalry and nonexclusiveness) and in the more popular interpretation that governments—in their role as road authority—are usually responsible for these facilities. This has led to an active road safety policy being pursued by various public authorities.

A traffic system without public-sector responsibility might be conceivable for its human and vehicle components, but not for roads. Furthermore, road network construction and maintenance often form the key rationale for the existence of a public-sector authority.

This means that it has been good that the government has taken the lead to improve road safety in the past and that it is difficult to imagine how it could be any different in the future. The role of social organizations can partly be responsible for implementing the policy that the government has formulated. On the other hand, these groups can try to influence the government to ensure that a "more and better" road safety policy is being followed.

Then the question arises about which policy is effective and how this policy can be implemented as efficiently as possible. This question reverts to the question of why crashes actually happen and how they can best be prevented. During the past, this question has been answered in many different ways. Furthermore, in 2006 this question has been answered very differently by the road safety world. As long as professionals, organizations, and public opinion think differently, this lessens the effectiveness of policy performance. Policy formulating is influenced and shaped by many different perspectives. Different insights cause confusion, can demotivate, and lessen the possibility of cooperation and synergy. There is thus every reason to pause and look at the various insights.

Causes of road crashes and remedial measures

"Human action is a contributory factor in over 90% of road crashes. The principal emphasis of all road safety strategies must therefore be on improving road user behavior. This behavior needs to be informed and trained, and to be modified, so as to improve interaction between road users, to ensure consideration for others, and to reduce risk. In this way, a culture of road use is created that is both precautionary and proactive in relation to road safety." These sorts of sentences can be found in many policy reports on road safety, and international research supports the truth of these statements.

Human errors (in observations, decisions, and actions) play their part in just about every crash, and the point is to eliminate them and, if they still do occur, not to let them lead to severe conse-

quences. This sentence gives the impression that human errors are much more important than errors in road design and that vehicle factors hardly play a part in causing crashes. A second conclusion for a superficial reader could be that crashes should mainly be combated by behavioral changes to be achieved by police surveillance, education, public information, and driving courses. Furthermore, it could be concluded that technical measures could prevent a marginal part of all crashes. These conclusions are not logical and, moreover, do not reflect the most recent road safety insights.

During the years of motorized traffic, there have been very many different ways of tracing crash causes and how they can best be avoided. Table 3 presents, by means of a few words, what the dominant thoughts in the OECD countries were (see also OECD 1997).

Without dealing with them extensively, there are a number of interesting conclusions to be drawn from this historical overview. First of all, the "crash-prone theory" dates primarily from the phase in which the legal guilt question was the main one: which road user has broken which law and is, thus, both guilty and liable. This question was answered by the police on the registration form of a crash, finally decided inside or outside the court room, and used by insurance companies to determine how to compensate damages. In-depth studies have shown that there are few mono-/single-cause crashes; they are usually caused by and the result of a combination of circumstances.

Table 3. Road safety "causes" as seen in time. Derived from OECD (1997).

Period	Characteristic
1900–1920	Crashes as chance phenomenon
1920–1950	Crashes caused by the crash-prone
1940–1960	Crashes are mono-causal
1950–1980	A combination of crash causes fitting within a "system approach"
1980–2000	The person is the weak link: more behavioral influence
2000–	Better implementation of existing policies "Sustainably Safe": adapt the system to the human being

Two other conclusions are relevant here. More "education" is not the best way of preventing human errors. A postal delivery company incurred a lot of damage to parcels because the employees threw them around. Throwing parcels was then forbidden and, because it still happened, they were told not to do it anymore. In spite of this, when the management decided to pack the parcels better, the company's damage decreased. In traffic, the question has been: should the human adapt to traffic or should traffic adapt to the human? Nowadays, the answer to this is *both*. This means that we cannot prevent human errors only by educating, informing, and

sometimes punishing people. We must provide people with surroundings in which the chance of human errors is limited. This is the essence of the philosophy in Sweden (Vision Zero) and the Netherlands (Sustainable Safety).

Finally—do crash-prone road users really exist? Are a small number of road users responsible for a large number of crashes? The answer is: only to a very limited extent. Situations with an increased risk are well known (alcohol, speed, poor visibility, inexperience, etc.). However, we know that having had a crash is not a good predictor of future crash involvement. Committing traffic offenses does correlate with crash frequency: the more offenses, the higher the crash frequency. The question should be asked about the extent in which the crash-prone approach can be more effective, not for the crash-prone themselves, but, by paying attention to this group, trying to promote good driving behavior in general.

It is important to understand that there are various ideas among road safety professionals about what the most important crash causes are and what the best way to prevent them is. A discussion about these paradigms can possibly uncover a difference of insight and then lead to a consensus. Social organizations can pay an important contribution to these discussions among professionals and with the public.

This difference in insight is just as important if one is trying, for certain road safety measures, to win the support of social organizations and interest groups and, ultimately, citizens and the politicians. In the Netherlands, popular support is very important for winning political support. Various groups play an important part in this: politicians, social organizations, scientific institutes, policy civil servants, and the media. There are complicated interactions that do not follow fixed patterns, and their results are not predictable.

During the last few years, we have seen the appearance of two main lines (paradigms) in road safety. The *first* one is especially aimed at effective and efficient policy implementation. A lot of information has become available about several road safety interventions (see e.g., Elvik and Vaa 2004), and the idea here is not to develop new policy interventions but to improve the quality of implementing existing ones using evidence-based or research-based information. Greater effectiveness is a matter of scale and quality. Improving road safety in such a way that the number of casualties substantially decreases generally requires a considerable effort, given the relatively low frequency of crashes, their low densities in space, and the modest effects of most safety interventions. Large enough scale is a matter of sufficient means. There is also the quality of interventions and with it not only the effectiveness but also the efficiency of investments, i.e., the effect achieved per dollar invested. Knowledge and expertise are features of quality, and promoting road safety requires professional knowledge and should not be left to well-meaning amateurs.

The *second* one is the Sustainable Safety idea (see also Wegman and Aarts 2006). This paradigm assumes two observations: a) the current traffic system is inherently dangerous and b) intensifying current efforts could lead to fewer casualties but not to substantially safer traffic.

Sustainable Safety

The Sustainable Safety vision, as described in Koornstra et al. (1992), aims to prevent crashes and, if this is not possible, to reduce crash severity in such a way that (serious) injury is almost precluded. These objectives use a proactive approach of studying those traffic situations in which serious-injury-producing crashes can occur. The next stage involves two options: either the circumstances are changed in such a way that the crash risk is almost totally removed or, if a crash is inevitable, serious crash injury risk is eliminated. "Serious injury" is defined here as fatal injury, life threatening injury, injury-causing permanent bodily damage, or injury-requiring hospital admission.

In the analysis of and approach to preventing crashes or reducing the severity of consequences of dangerous situations, human capacities and limitations are the guiding factors: *"man is the measure of all things."* The central issue is that people, even if they are highly motivated to behave safely while using the road, make errors that may result in crashes. In addition, man is physically vulnerable, and this has consequences for injury severity when a crash occurs.

Taking into account these human characteristics as the starting point, sustainably safe road traffic can be attained by an integral approach to the components: "man," "vehicle," and "road." This means that the infrastructure has to be designed such that it meets human capacities and limitations, that the vehicle supports the performance of traffic tasks and provides protection in the event of a crash, and that the road user is well informed and trained, and is controlled wherever necessary in the correct performance of the traffic task.

Reducing latent errors in the traffic system

Crashes are virtually never caused by one single dangerous action; in most cases a crash is preceded by a whole chain of events that are not well adapted to each other. For example, one or more dangerous road-user actions may cause a crash, or deficiencies in the traffic system may contribute to dangerous actions by road users leading to crashes. These system gaps are called "latent errors" (see Rasmussen 1983 and Reason 1990).

Latent errors occur in the following elements of the traffic system:

1. The traffic system is defined as the organized whole of elements that create the conditions for traffic, such as:
    - Design of the system, where the potential for road crashes and injuries have been insufficiently taken into account.
    - Quality assurance in the establishment of components of the traffic system. Inadequate or lack of quality assurance of traffic system components can lead to errors that have implications for road safety.

- Defense mechanisms limited to the traffic system itself. These do not comprise the defense mechanisms employed by road users while actively taking part in traffic, but, for instance, error-tolerant or forgiving infrastructure or Intelligent Transport Systems may help prevent a crash. These defense mechanisms are the last component in the chain leading up to a crash that can prevent latent errors and dangerous actions from actually causing a crash.

2. Psychological precursors of (dangerous) actions. These are the circumstances in which humans actually operate or the states they are in that increase the risk for dangerous actions during active traffic participation.

Road traffic is characterized by a great many latent errors, particularly compared with other transport modes. Therefore, current road traffic has to be considered to be inherently dangerous. In the end, crashes occur if latent errors in the traffic system and dangerous actions coincide in (a sequence of) time and place during traffic participation (Figure 4).

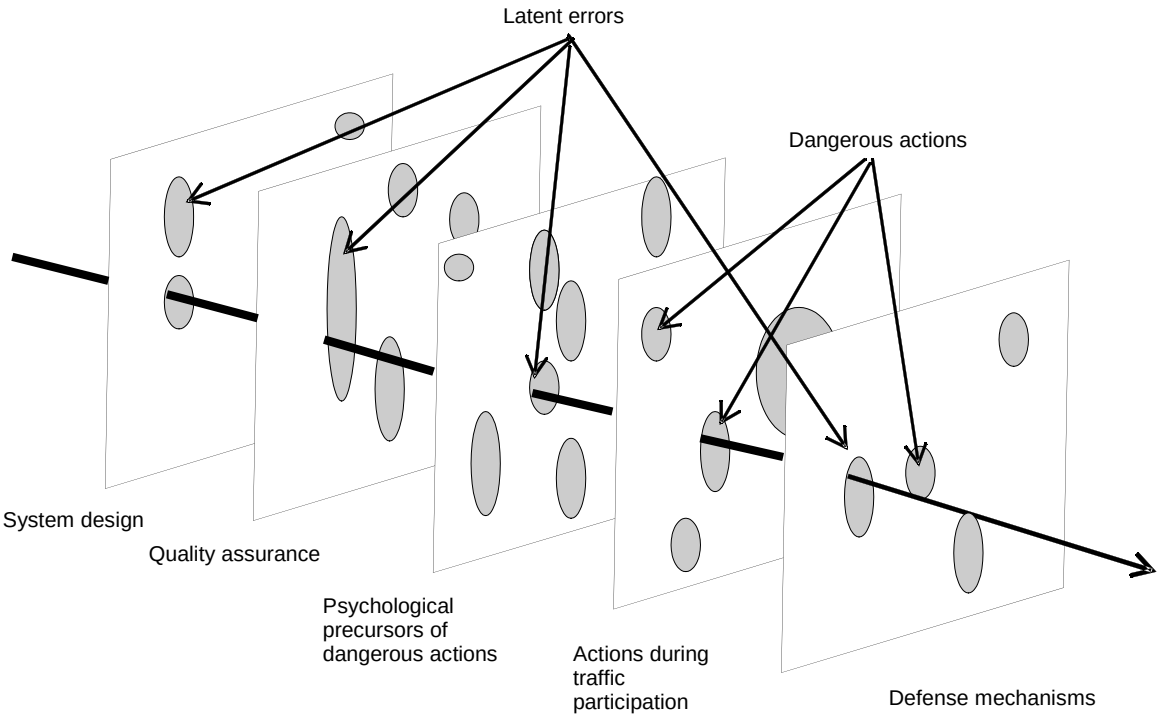


Figure 4. Schematic representation of the development of a crash (big arrow) caused by latent errors and dangerous actions in different elements in road traffic (free after Reason 1990). If the arrow encounters somewhere, a crash will not occur.

Because dangerous actions can never be completely avoided, the Sustainable Safety vision strives to remove latent errors from traffic: the traffic system has to be forgiving to dangerous actions by road users, so that these cannot lead to crashes. The sustainable nature of measures is

characterized by the fact that actions while taking part in traffic are less dependent on momentary and individual choices that can be less than optimal, and, consequently, increase risk.

Adapting the environment to human capacities and limitations comes from cognitive ergonomics (also referred to as "cognitive engineering"), originating in the early 1980s from the aviation and process industries. In fact, this way of thinking has led to an advanced safety culture in all modes of transport, except road transport. Further incorporation of the Sustainable Safety vision should ultimately lead to a situation where road transport can also be considered as "inherently safe" because of such an approach.

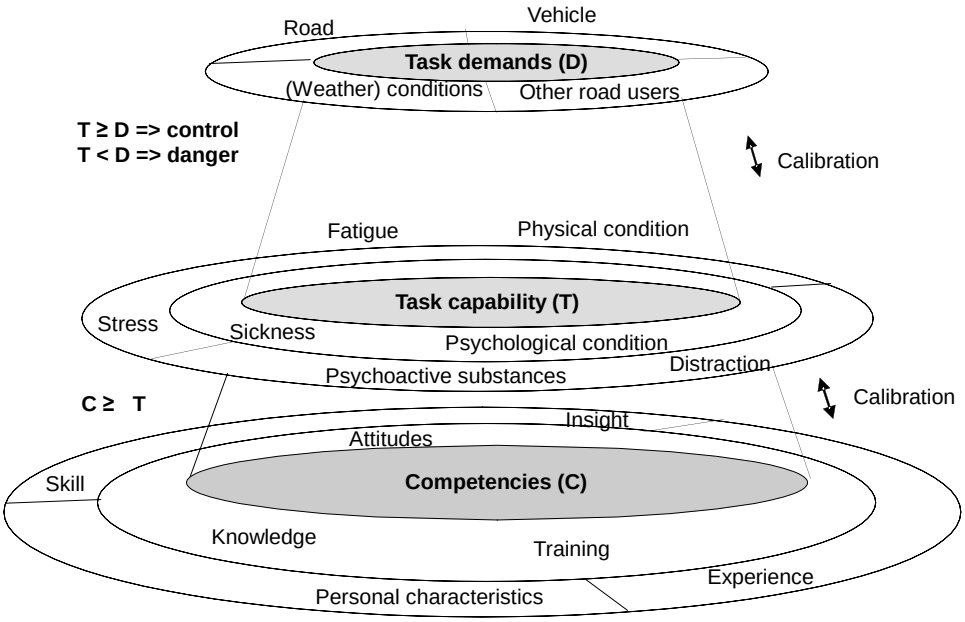


Figure 5. Schematic representation of Fuller's model: task demands (D) can only be met if task capability (T) is great enough. Task capability is the result of competencies (C), minus the situation-dependent state (in Wegman and Aarts 2006).

Another model that helps to understand the choices that are made within the Sustainable Safety vision—with man as the measure of all things—is the task capability model created by Ray Fuller (see 2005 for the most recent version). Fuller hypothesizes that a road user keeps the difficulty of the task, rather than the subjective risk, constant. In this theory, this subjective measure depends upon the ratio between the objective task demands and the driver's capability to accomplish this task. This task capability consists of a person's competencies, minus his situation-dependent state (Figure 5). People lose control over a situation if the task demands exceed the capability to execute the task. This is, of course, a breeding ground for crashes. Only an optimally designed, forgiving environment in combination with adequate responses of other road users can then prevent an injury crash. The task demands are, in the first place, influenced by road design, traffic volume, and the behavior of other road users, but the road user can influence

the task demands in part, for example, by increasing speed, or engaging in secondary, distracting activities, such as using a mobile phone.

As is also known from the old arousal theory, people have a tendency to keep the difficulty of tasks (and consequently the corresponding activation level) at a reasonably constant and optimal level. In Fuller's model, this means an optimal ratio between task capability and task demands. If the task demands become too small relative to the task capability (e.g., being hale and hearty and well trained and driving at low speeds on a boring straight stretch of road with no other traffic), then people have a tendency to make the task more difficult to lift the feeling of boredom. Conversely, if the task demands are about to exceed the safe task capability (e.g., making a phone call while driving in busy traffic at high speeds), the driver will try to make the task easier.

The selected balance between task capabilities and task demands differs between individuals, as certain groups of drivers (e.g., young male drivers) tend to accept higher task demands relative to their capabilities, and consequently run a higher risk of crash involvement.

Taking into account physical vulnerability

In addition to human psychological characteristics, physical characteristics also play an important role in creating sustainably safe road traffic. The central issue is that human beings are physically vulnerable in impacts with comparatively big masses, hard materials, and large decelerations acting on the human body. The combination of these factors can cause serious injury, sometimes with irreversible effects, and even death. Some of the forces released in a crash are absorbed by the vehicle (if present). This means that people involved in a crash sustain less (serious) injury as vehicles absorb more released energy. This also means that higher crash speeds and travel speeds are acceptable if the vehicles are more crash protective in their design, if vehicle occupants are wearing seat belts, if airbags are present, etc.

Given that people make errors, it is important in creating a sustainably safe road traffic system to design the environment such that these errors cannot lead to crashes or, if this is impossible, do not cause serious injury. The human body's vulnerability to injury, along with the important influence of speed on crash severity, is the starting point for a proposal for safe travel speed by Claes Tingvall, one of the founding fathers of the Zero Vision in Sweden (Tingvall and Haworth 1999; Table 1).

The starting point for this proposal is designing modern, well equipped cars and 100% use of seat belts and child restraint systems. However, safer speeds ought to be used in crash tests (such as in New Car Assessment Programs) but also in tests for protective design. In addition, as the car fleet does not yet consist of the best designed cars and seat-belt use is not yet 100%, the proposed speeds are too high for the current conditions. A higher degree of penetration of the best designed cars is necessary before the proposed speeds can be viewed as "the maximum allowable speeds." Taking the current fleet conditions and seat-belt use into account, it is,

however, hard to say what are safe speeds at this time, other than that they are lower than the speeds listed in Table 4. These speeds are neither valid for motorcyclists, for example, who are much more vulnerable nor for crashes with relatively heavy vehicles, such as trucks.

Table 4. Proposal for safe speeds in particular conflict situations between traffic participants (Tingvall and Haworth 1999).

Road types combined with allowed road users	Safe speed (km/h)
Roads with possible conflicts between cars and unprotected road users	30
Intersections with possible conflicts at right angles between cars	50
Roads with possible frontal conflicts between cars	70
Roads with no possible frontal or lateral conflicts between road users	≥ 100

To summarize Sustainable Safety

Given the fact that people make errors, they do not always comply with rules, and moreover, they are vulnerable, it is essential to prevent latent errors (or gaps) in the traffic system. According to the Sustainable Safety vision, in order to prevent serious unintentional errors, the environment and the task demands that this environment entails have to be adapted to a level that the majority of road users can cope with. This produces desirable behavior almost automatically —the road user knows what to expect, and possible errors can be absorbed by a forgiving environment. This also makes the breeding ground for intentional or unintentional violations less fertile. In so far as violation behavior prior to traffic participation can be detected (such as alcohol consumption or not having a driving license), denying traffic access fits within sustainable safe road traffic.

Road users have to be well informed and experienced to participate in traffic. Where their skills and capabilities do not meet the task demands, their safe behavior needs to be encouraged by means of specific measures. It is essential that road users are aware of their situation-dependent states and, consequently, their task capabilities, to take adequate decisions that may prevent potential crashes. Because there are differences in road-user capabilities, we should ask more experienced road users to engage consciously in safe traffic behavior directed at less experienced road users. A forgiving driving style can absorb the emergence of crashes caused by other road users as a social system.

The vulnerable human has to be protected in traffic by the environment by means of structures that absorb the kinetic energy released in a crash. To this end, the mass of vehicles sharing the same space needs to be compatible. If this is not possible, then speeds need to be lowered. This system is embedded in a traffic planning taxonomy of fast traffic flows on the one hand and

access to residences on the other. Between these two extremes, traffic has to be guided in good, sustainably safe ways.

We finally arrive at the five central principles on sustainably safe road traffic: functionality, homogeneity, recognizability, forgivingness, and state awareness. A short description of these principles is given in Table 5.

Table 5. The five Sustainable Safety principles (Wegman and Aarts 2006).

Sustainable Safety principle	Description
Function of roads.	Mono-functionality of roads: as *either* flow roads, or distributor roads, or access roads, in a hierarchically structured road network.
Homogeneity of masses and/or speed and direction.	Equity in speed, direction, and masses at medium and high speeds.
Predictability of road course and road-user behavior by a recognizable road design.	Road environment and road-user behavior that support road-user expectations through consistency and continuity in road design.
Forgivingness of the environment and of road users.	Injury limitation through a forgiving road environment and anticipation of road-user behavior.
State awareness by road user.	Ability to assess one's task capability to handle the driving task.

Summary and recommendations

Traffic in the Netherlands is among the safest in the world, and this position has been reached by investing in road safety quality during a period of many decades. However, the Netherlands is not satisfied with the current traffic safety level. Striving for even greater safety is rooted in the understanding that many unnecessary road traffic casualties occur because road traffic is inherently unsafe. The current road traffic system was not designed with safety being an important criterion. Realizing this is essential for further improvements.

This does not mean that it is an easy matter to prevent all serious crashes. That is probably impossible. In the past, we have looked at different ways to find the best one for preventing road crashes. This was attempted by using different paradigms that, first of all, had to be placed in the spirit of the times. On the other hand, scientific research has made our knowledge and insight much richer, and we now know quite well which interventions work and which do not. In the Netherlands a new paradigm was recently developed—Sustainable Safety.

Our insight into how social organizations and government can cooperate more efficiently to increase road safety has flourished. This is a complicated process in which politics, policy, civil servants, social organizations, scientific institutes, and the media each fulfills a role. There are no fixed patterns. Two subjects invariably play a role: how to get and keep road safety high up on the political agenda, and how to create support in society for road safety improvement measures.

They can cling to the fact that in a highly developed society there is a strong undercurrent for risk management and quality stimulation. However, this process requires continuous attention and requires that stakeholders are and remain involved in policy implementation, with as its motto: *knowing, being able, and wanting*. Government should then organize itself in such a way that effective and efficient measures are taken that either, in advance, can rely on a large public support or in which social organizations make society ripe for acceptance. Political leadership, a leading agency, and road safety champions are key ingredients for successful policies.

I recommend the examination about how to give this process further shape, in the Netherlands and in the United States. It is difficult to imagine why the United States could not be one of the safest countries in the world if it wanted to be, and why the annual number of casualties could not decrease further. As a yardstick, I would not choose fatalities per unit of travel but the absolute number of casualties per inhabitant. But this involves examining how the American citizen views the question of why there are road crashes at all, who is responsible for them, and how these can best be prevented. This is a study of the safety culture of a country. Then, as in the SUNflower project or via the so-called US scanning tours, benchmarking can be used to discover where the improvement possibilities lie. This benchmarking should concentrate on "how to do?" and not on "what to do?" Such discussions are still going on in the Netherlands. Although road traffic in the Netherlands is relatively safe, we do not regard it as being safe enough.

References

Buchanan, C. 1963. *Traffic in towns; A study of the long term problems of traffic in urban areas.* Her Majesty's Stationery Office, London.

Elvik, R. and T. Bjørnskau. 2005. How accurately does the public perceive differences in transport risks? An explanatory analysis of scales representing perceived risk. *Accident Analysis and Prevention* 37:1005–11.

Elvik, R. and T. Vaa. 2004. *The handbook of road safety measures*. Elsevier Science: NY: Amsterdam.

European Commission. 2001. *European transport policy for 2010: Time to decide*. White paper. Office for Official Publications of the European Communities, Luxembourg.

European Transport Safety Council (ETSC). 2003. *Transport safety performance in the EU. A statistical overview.* Brussels.

Fuller, R. 2005. Towards a general theory of driver behaviour. In: *Accident Analysis and Prevention* 37 (3): 461–72.

Glasbergen, P. 1987. Beleidsuitvoering als probleem: oorzaken en perspectieven. [in Dutch] In: P. B. Lehning and J. B. D. Simonis, eds. *Handboek Beleidswetenschap*, 80–93. Meppel.

Goldenbeld, Ch. 2003. Meningen, voorkeuren en verkeersgedrag van Nederlandse automobilisten.[in Dutch] [*Opinions, preferences, and traffic behaviour of Dutch motorists*]. R-2003-25. SWOV, Leidschendam.

Johnston, I. 2006. *Halving roadway fatalities. A case study from Victoria, Australia 1989–2004.* FHWA, Office of International Programs. Washington, DC.

Koornstra, M., D. Lynam, G. Nillson, P. Noordzij, H. E. Pettersson, F. Wegman, and P. Wouters. 2002. *SUNflower: A comparative study of the development of road safety in Sweden, the United Kingdom, and the Netherlands.* SWOV, Leidschendam.

Mazmanian, D. A. and P. A. Sabatier. 1981. *Effective policy implementation*. Lexington, Massachusetts.

NHTSA. 2005. *Traffic safety facts 2004. A compilation of motor vehicle crash data from the fatality analysis reporting system and the general estimates system*. Washington DC.

OECD. 1997. *Road safety principles and models*. Organisation for Economic Co-operation and Development. Paris.

Peden, M., R. Scurfield, D. Sleet, D. Mohan, A. A. Hyder, E. Jarawan, and C. Mathers, eds. 2004. *World report on road traffic injury prevention.* World Health Organization (WHO). Geneva.

Rasmussen, J. 1983. Skills, rules, and knowledge; Signals, signs, and symbols, and other distinctions in human performance models. In: *IEEE transactions on systems, man, and cybernatics*, SMC-13: 257–66.

Reason, J. 1990. *Human error.* Cambridge University Press, Cambridge.

Tingvall, C., and N. Haworth. 1999. Vision Zero: An ethical approach to safety and mobility. In: *Proceedings of the 6th ITE International Conference—Road safety and traffic enforcement: Beyond 2000*. Melbourne.

Wegman, F. C. M. 2001. *Veilig wat heet veilig?: SWOV-visie op een nóg veiliger wegverkeer.* [*Safe, what is safe?: SWOV vision on even safer road traffic*.] (In Dutch.) R-2001-28. SWOV, Leidschendam.

Wegman, F., V. Eksler, S. Hayes, D. Lynam, P. Morsink, and S. Oppe. 2005. *SUNflower+6. A comparative study of the development of road safety in the SUNflower+6 countries: Final report*. SWOV, Leidschendam.

Wegman, F., and L. Aarts, eds. 2006. *Advancing sustainable safety.* SWOV, Leidschendam.

Wong, S. C., N. N. Sze, H. F Yip, P. Y. Loo, W. T. Hung, and H. K. Lo. 2006. Association between setting quantified road safety targets and road fatality reduction. *Accident Analysis & Prevention* 38 (5): 997–1005.

Biographical statement

Fred Wegman has been managing director of the national Institute for Road Safety Research SWOV in the Netherlands since 1999. Previously, he served as research director of SWOV. He has authored numerous scientific articles and reports, conference presentations, and seminars. His areas of expertise include developing road safety strategies and implementation programs, as well as road safety research programs and evaluation studies on various road safety topics. He is coeditor of *Advancing Sustainable Safety* (2006), the Dutch vision on road safety.

Fred Wegman has been the coordinator of grants and contracts of several European research projects. He is a member of several international committees, including the Joint Transport Research Centre of the OECD/ECMT, the European Transport Safety Council, and the Board of Forum of the European Road Safety Research Institutes, FERSI. He lectures on road safety at the

Delft University of Technology, and is associate editor of the journal *Safety Science*. He is advisor on road safety to Dutch Parliament and the Dutch government, the European Commission, and many countries around the world. Fred Wegman has a masters degree in civil engineering from the Delft University of Technology.

Road safety culture development for substantial road trauma reduction:

Can the experience of the state of Victoria, Australia, be applied to achieve road safety improvement in North America?

Eric Howard

VICROADS, Australia

Peter Sweatman

University of Michigan Transportation Research Institute (UMTRI)

Overview

The State of Victoria, Australia has improved its road safety performance substantially in the periods 1989 to 1992 and since 2001. The lessons learned from this experience suggest that mechanisms by which governments and communities can achieve improved road safety outcomes are not well understood and have received little research attention. A clear recognition and understanding of principles and processes which will assist change are fundamentally important if new countermeasure proposals are to achieve community acceptance over time. Proponents of change need to be well equipped if their ideas are to negotiate the difficult course of public debate and bring about greater acceptance (albeit, often incrementally) in public attitudes.

This paper outlines the new road safety thinking developed in Victoria, Australia including the focus on road safety performance measurement which is a key driver of road safety management. It compares road safety outcomes with the current situation in the USA. The paper suggests that consideration be given to implementation of a tailored pilot implementation in selected states of the US. Such implementation would be based, in particular, on a more complete understanding of how the transition from concept to implementable reality can occur.

Introduction

Any community can have the level of road trauma it is prepared to accept. The challenge in achieving beneficial change is to galvanize awareness of facts about crash risks, develop and promote an understanding of options available to reduce these risks and associated trauma, and achieve community ownership (with leadership by governments) of the solutions.

While the US has shown leadership in vehicle and highway technologies for reducing the consequences of crashes and for avoiding crashes, Victoria, Australia has demonstrated leadership in many community-based road safety initiatives over the past 35 years. While many of these Victorian initiatives have employed technology, there has been an overarching focus on the raising of

risk awareness in the community. Since 1970, initiatives such as compulsory wearing of seat-belts, random breath testing for alcohol, mandatory bicycle helmet wearing and most recently, random roadside saliva testing for drugs and tough speed enforcement have been pioneered on an international basis in the Victorian community.

While Victoria has a long tradition of innovative road safety action by governments, there has been a concerted effort since 2001 to implement a further extensive list of road safety initiatives, including expanded speed enforcement, lower speed limits and speed enforcement thresholds, tougher penalties for speeding and drink driving, extensive targeted infrastructure safety investment programs, introduction of alcohol interlocks for drunk-driving offenders and random roadside saliva testing for drug-impaired drivers, immobilization of vehicles of disqualified drivers, promotion of adopted vehicle safety and motorcycling safety strategies, adoption of measures to extend graduated licensing arrangements to improve novice driver safety, and an accompanying extensive range of supporting public information campaigns.

These initiatives have resulted in the Victorian road toll falling to an all time low with the State's three lowest tolls recorded in the last three years. Fatality metrics, whether determined as total annual fatalities or as rates per head of population, per registered vehicle or per kilometer of travel have all fallen substantially. The fatality rate per 100,000 population for the past twelve months has fallen to 6.3.

It is interesting to contrast crash rates in the Australian State of Victoria with those in Michigan, USA; these are the two home States of the authors. Michigan, USA has for many years been a powerhouse of the worldwide automotive industry and has, therefore, produced many vehicle innovations which have improved safety. Michigan is a highly motorized state with an extensive and diverse highway network which incorporates some of the most sophisticated infrastructure in the nation, along with certain areas which have lacked attention. The fatality rate per 100,000 population fell to 11.8 in the twelve months 2004 through 2005, and fatality rates have also been decreasing.

Michigan has a long record of attention to road safety. Michigan established a Governor's Traffic Safety Commission as long ago as 1941, involving representatives from transportation, health, education, and police. Michigan also established a Truck Safety Commission in 1988, with assistance from industry and unions, and developed an emphasis on innovative enforcements programs through the Department of State Police, Motor Carrier Division. As required in the current federal highway authorization bill—SAFETEA-LU—Michigan has developed a Strategic Highway Safety Plan which sets a goal of 1.0 fatalities per 100 million vehicle-miles traveled by 2008; this equates to 10.8 fatalities per 100,000 population, an improvement on the current fatality rate. Michigan also made significant progress from 1995 to 2004 with traffic deaths falling 24.6% to represent a rate of 11.5 fatalities per 100,000 population. Nevertheless, the current Michigan fatality rate remains much higher than that in Victoria: 11.8 fatalities per 100,000 population versus 6.3 fatalities per 100,000 population. Can differences in the safety culture of the two States, more than differences in actual safety programs, help explain this large apparent gap in safety performance?

Comparison of changes in absolute fatality levels in the United States and Australia (and Victoria) between 1995 and 2003 is instructive. The number of persons killed in road crashes in

the United States has increased by 2 percent in those nine years. In contrast, the number of persons killed in Australia has decreased by more than 20 percent in the same period and by 21% in Victoria.

This disparity indicates the major opportunity that exists to reduce deaths of Americans on their road network.

Many of these gains in Victoria have been hard won over a period of years as the battle to change public attitudes towards fresh potential and actual initiatives was waged in the media, at the political level, with special interest groups, and in the broader community. It is a tough task and requires relentless energy to address constant, uninformed reactions to suggestions for change.

How have so many contentious measures made it onto the starting blocks and successfully run the gauntlet of often hostile initial public reaction to become accepted practice over time for a majority of the community?

What are the new approaches that could be utilized to achieve fundamental and ongoing road safety improvement in other jurisdictions?

Potentially, there is substantial benefit for all jurisdictions to embrace new thinking, including a better understanding of enabling factors required to overcome barriers to acceptance which exist in their environments: the "how" of developing, maintaining, and strengthening a safety culture. This is asserted to be so, even in situations where current cultures are very different from Australian/Victorian settings. While the starting point is, of course, highly relevant to the challenges to be addressed and will be different from country to country, it is the quality of the approach, the tools and methods proposed for use, and the commitment to achieving successful outcomes that will deliver benefits.

While this paper utilizes crash rates and international comparisons in an illustrative sense, it is recognized that there are many subtle differences in methodologies used in crash statistics and many qualitative and quantitative differences in exposure to crashes. For example, the amount of vehicle miles of travel per head of population is higher in the USA than in Australia.

New thinking in road safety

The sheer volume of road use—numbers of vehicles, numbers of drivers, and distances traveled—increases inexorably over time. Unless improvements in the rate of safety outstrip increases in the volume of road use, then the total number of people seriously injured or killed will increase. This is exactly what is happening in the United States; while the safety rate per mile traveled has improved, the improvement has slowed over time and is not at a sufficient level to prevent an increase in the total numbers killed.

Table 1 shows that the number of persons killed in road crashes in the United States has increased by 2 percent in the past ten years. In contrast, the number of persons killed in Australia has decreased by more than 20 percent in the same period, with improvements in the rates of traffic safety two to three times greater than those achieved in the United States.

How do we explain these very different levels of performance? How can the issue be reconsidered in order to provide US citizens with the levels of road safety enjoyed by the world's most developed countries? It is suggested that the approaches adopted in Victoria, Australia be carefully considered and that the experience obtained there be drawn upon to build new approaches to road safety in the United States.

Table 1. Road traffic fatalities between 1995 and 2004.

Country	Time	Total deaths	Deaths per 100,000 population	Deaths per 10,000 vehicles
United States	1995	41,798	15.9	2.1
	2004	42,636	14.7*	1.8*
	% change	+2%	−8%	−14%
Australia	1995	2,013	11.2	1.8
	2004	1,596	8.0	1.2
	% change	−21%	−29%	−33%

* 2003 Source: Data extracted from Web sites of USDOT and Australian Transport Safety Bureau

As illustrated in Figure 1, Victoria has adopted "new thinking" in the way it tackles this issue, building of course upon proven established measures, but looking at the challenges in a different way.

What is this "new thinking" that has underpinned Victoria's efforts? How can these elements be implemented in a successful manner in a different environment?

Based on the Victorian experience with raising government and community risk awareness, the following critical areas of new thinking offer particular promise for research (as pilot implementations) for changing the traffic safety culture in the US. The four critical areas are:

1. Performance measurement
2. Effective leadership, management and co-ordination
3. Adopting a safe system approach and a strategy with targets
4. Promoting a social contract approach

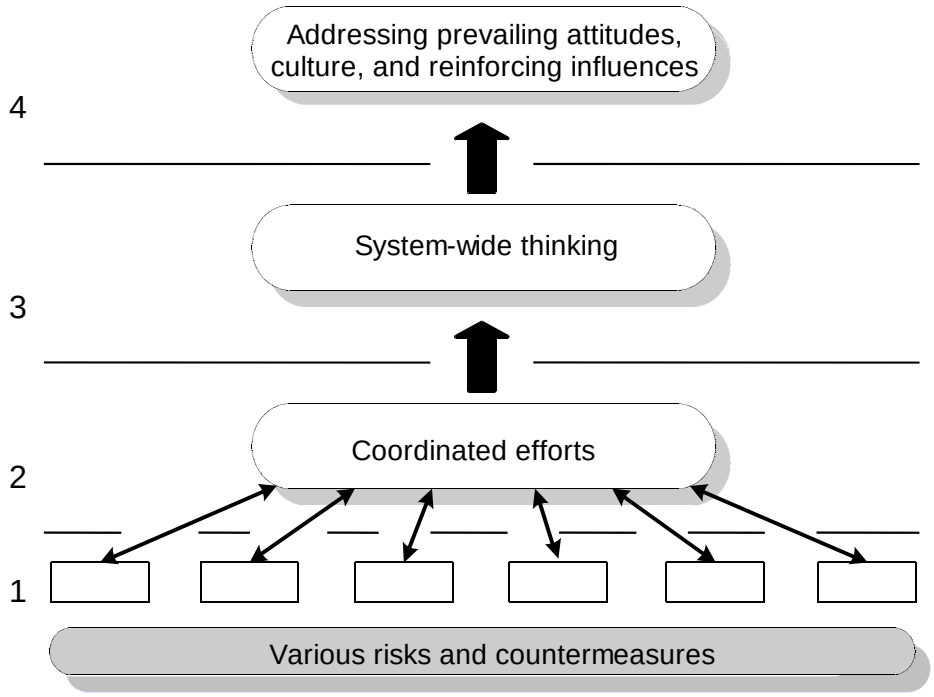


Figure 1. Increasing levels of road safety management capacity and effectiveness.

Performance measurement

The FHWA Scan team that conducted a Study of Performance Measurement in Road Authorities in selected Pacific countries in 2004 commented in their Report—with particular relevance to the visit to Victoria, Australia—**"Safety was viewed as a strategic use of performance measurement that has resulted in a significant decline in fatalities. A great deal can be learned from this application of performance measurement, especially as it relates to the identification of strategies and actions that need to be put in place to achieve reductions in road fatalities."**

The importance of a clear understanding of your current position

Critical to any effective development of strategies and actions to improve road safety is a clear understanding of current issues and recent (for example, three-year) crash trends.

A preparedness to measure detailed performance by assessing road trauma levels against other jurisdictions—nationally and internationally—ensures that practitioners "know their business." It can also provide a reality check at the senior executive and political levels and encourage further development of proposals to improve that jurisdiction's relative position.

Accurate assessment of these issues depends upon effective capture and analysis systems which collect and process a comprehensive set of data.

Collection and recording of a key set of outcome measures are essential. These include fatalities, serious and minor injuries, age and sex and category of road users involved in crashes, crash types, crash locations, road conditions, vehicle types in crashes, those crashes involving alcohol and/or speeding, and /or where seat-belts and helmets were not worn. Monitoring and necessary periodic analysis of this data on an ongoing basis are important means of focusing interest and encouraging an action-oriented approach to crash reduction. Both Victoria and Michigan have highly effective crash data capture and analysis systems.

In Victoria, a daily summary of fatalities by user category comparing last year-to-date to the figures for the current year-to-date (up to midnight the previous evening) are provided on the desks of relevant politicians and key agency staff before 8 am each weekday. The material is available to the public and the media on the web. There would be few, if any, jurisdictions in North America where this occurs. This approach generates interest and discussion and can raise the priority of road safety issues compared with other government programs in the minds of senior officials and elected members.

It is also vital that a range of intermediate measures are collected on an ongoing basis. These typically include the mean and 85th percentile free-speed levels, percentage compliance rates at speed and red-light camera sites, seat belt wearing and helmet wearing rates, the proportion of the fleet with key safety features fitted (such as electronic stability control), alcohol-impaired driving rates, drug-impaired driving rates and the results of community attitude surveys over periods of time on specific issues.

This relentless emphasis on measurement is akin to the business management practices embodied in the “balanced scorecard.” All levels of the enterprise must have specific measures which are relevant to their activities and are connected to the next level.

In addition, records of input effort by the agencies are necessary to enable comparison of outcomes, particularly any change in crash trends with any changes which may have occurred in levels of inputs. This is especially important for enforcement effort, where behavior can deteriorate quite rapidly if enforcement levels reduce significantly.

Measurement and ongoing monitoring should also include detailed assessment of vehicle safety levels and the presence of safety features in the fleet plus road-network risk levels across the whole network for various categories of roads.

Sophisticated tools are now available to cost-effectively produce risk ratings along a road based upon physical and traffic data inputs. For example, ARRB Transport Research has developed “NetRisk”—a road network safety assessment tool. It is designed to enable road authorities to rapidly assess the safety condition of any section of the road network. It involves a network level assessment, based on collection and analysis of extensive physical road environment data—utilizing intelligent video data capture—to identify high-risk sections of the network followed by a detailed investigation of the high-risk sites within those sections to develop specific cost-effective treatments. This approach is being used in Victoria by VicRoads, the State road authority and by other road authorities in Australia

It is necessary to conduct an analysis of the data and publish it widely within the road safety agencies and Ministries. The purpose is to have the data presented in such a way that it “speaks for itself” and contributes strongly to driving debate and discussion about trends, progress, and

further countermeasures. North American road safety would benefit from this much more proactive approach to data awareness.

Monitoring adverse trends

There are activities in any society where adverse links to road safety risks and outcomes can be established. These include increased travel exposure, the rate of aging (and, therefore, increased fragility) of a population, increased higher-strength alcohol consumption in a community (e.g., the growth of a mixed-drink culture), and increases in unacceptable motor vehicle advertising. Such trends need to be monitored and any increased activity identified as quickly as possible; proposed countermeasures should then be developed purposefully, promoted to the public, and introduced.

The need for leadership and effective management and co-ordination arrangements

Clear political leadership is essential for effecting road safety change at a transformational level, and this is the second area where it is asserted "new thinking" can deliver major benefits.

While there are many models of management and co-ordination internationally, Victoria has adopted a Ministerial Road Safety Council (now a Cabinet Committee) of three Ministers—for Transport, Police, and the TAC, (the Government motor accident insurer)—which has responsibility to achieve improved road safety outcomes.

This is in contrast to most North American jurisdictions where the legislator responsible for road safety is usually only visible when some horrendous road crash has occurred and a reactive activity is taking place.

The approach in Victoria is a critically important mechanism to achieve strong representation for road safety initiatives at the Cabinet table, given the political trade-offs so often involved in the introduction of road safety measures, such as mobility, environment, privacy, and civil liberty or public safety impacts.

But this is hardly enough!

Victoria has developed a strong partnership between the key agencies:

VicRoads—Responsible for road infrastructure, traffic management, vehicle registration, driver licensing, commercial vehicle regulation, and road safety legislative development.

Victoria Police—Responsible for enforcing traffic safety legislation and regulations.

Department of Justice—Responsible for enforcement technology operation and traffic offense adjudication processes.

Transport Accident Commission (TAC)—The government-owned monopoly provider of no-fault injury compensation for transport accident victims in Victoria.

The overall road safety management arrangements in Victoria are shown in Figure 2 at the end of this paper.

How can collective and individual accountability be clearly defined, supported, and reinforced by management and reporting structures? Can this be extended to personal accountabilities of agency heads and senior staff? How can a real partnership focussed only on "the plan," willing to share success, recognizing the value of the participants and sharing leadership, be developed?

Any jurisdiction seeking to improve road safety outcomes needs to implement its own appropriate arrangements for leadership, management and co-ordination. But the accountability arrangements are crucial, and if a government sets out its requirements clearly in terms of outcomes (through a strategy plan, actions, and agreed targets) it is a clear signal of effective leadership and a powerful incentive for effective agency performance. In Victoria, there is clear individual agency responsibility for specific actions, but there are also numerous issues for which there is shared accountability between agencies. Reporting to the regular ministerial council meetings is through one consolidated reporting framework by the agencies. This requires that rare concept of "joined up government" to become a reality, requiring a great deal of energy and maturity from the key agency players. Are North American agency heads willing to reach out and embrace this shared leadership approach?

Designation of a lead agency is a vital and challenging issue. This needs to be "small l" leadership with the agency selected to "lead" charged with the responsibility to co-ordinate activities, (including strategy development and implementation and reporting on performance) and to convene meetings of the other agencies on a cooperative basis.

Chairing of those meetings of management, executive and ministerial groups could, however, be rotated between agencies.

How do we avoid doing the things which will undermine our intent and efforts? While government strategies and agency actions should focus on implementing actions that deliver certain benefits, thoughtful analysis is needed to guide initial efforts to those countermeasures where political and community support can be more readily achieved and which can be delivered in the desired time frame.

The benefits of:

- developing quality understandings of crashes and crash risk,
- assessing performance by crash type against other jurisdictions and monitoring trends within the jurisdiction,
- introducing regular and often small adjustments to legislation and regulations to improve deterrence and enforceability without drawing difficult adverse public reactions, and
- producing high-quality draft policy and business cases for government investment

need to be better understood by road safety agencies and practitioners.

These are important approaches, requiring patience and commitment from policy developers. It is also essential that high standards of organizational knowledge and capability are in place if policy proposals are to be soundly developed, regarded as credible, and supported by governments. Recognition that government intervention is essential to address certain issues in a society —including road trauma reduction—is also a prerequisite for public understanding and support for action.

What has been Victoria's experience in fostering Government preparedness to introduce challenging measures and agreement to further regulate individual behaviors and freedoms?

The importance of the nature and quality of the interaction between agencies and Ministers, Secretaries, and for the US–Governors.

Agency advocates need to be experienced—capable of depth and breadth in policy development, with a capacity to influence senior political figures.

Strengthening the capability and credibility of agency advice to government, including their processes for addressing externalities (in terms of policy impacts on nonroad safety areas), assessing levels of public support and the deliverability of outcomes.

Senior staff in the road safety agencies require a strong grasp of relevant community attitudes and aspirations and a comprehensive understanding of the requirements of public policy debate including media relations. It is also vital that impacts of proposed policies on areas other than road safety which may be considered adverse are actively addressed and constituencies engaged. However, it is also crucial that there is a realistic and hard-headed awareness of likely acceptance by the public of policy measures under consideration, certainly in the short to medium term. This implies the presence of experienced campaigners in the senior agency roles. This implies that sufficient incentives exist within the public sector to retain key competent people.

Use of measures which encourage agencies to work closely and effectively together to provide a whole of government view on policy, program, or operational matters to relevant Ministers and Secretaries.

Allocation of clear accountabilities to individual agencies and a joint reporting arrangement for multisectoral actions across more than one agency to a ministerial council will focus agencies on a whole of government approach. The multilevel organizational arrangements set out in Figure 2 are also a key support. How can these arrangements be replicated in the United States? Many thousands of lives could be saved annually in the US if this co-operation could be achieved.

The benefits of a published comprehensive Strategy, with Targets which stretch the efforts of the government and agencies and are based upon quantified outcomes of proposed measures.

While many jurisdictions internationally have adopted strategies and targets for road safety improvement, it is remarkable that very few have modelled the outcomes that could be achieved if specified inputs were pursued. It is essential, if targets are to be credible, that an objective methodology be developed, based on research outcomes, local evaluation of previous intervention programs, and based also on local conditions. Devising approaches which will optimize the likelihood that measures survive the policy development and public response phases is essential. Staged introduction or substantial education programs over one or two years before legislative initiatives are introduced are typical methods available to increase successful passage down the implementation pipeline.

Victoria has utilized the Monash University Accident Research Centre (MUARC) to prepare such models to assist this target setting process in a transparent way, in order to achieve greater political and public understanding of the target setting process and of the links between input countermeasures and evaluated outcomes.

Public consultation on draft strategies assists ventilation of proposed initiatives and encourages debate and understanding of the issues, especially at the Ministerial level.

There needs to be a range of independent inputs to the public debate about road safety issues beyond government. This is necessary to win public support for the development and introduction of policies and actions.

Some of these potential inputs include bipartisan parliamentary committees (such as the all-party Victorian Parliamentary Road Safety Committee), independent credible research organizations (such as MUARC), and other safety advocates (individuals and groups).

The insurance industry is an underutilized resource. In Victoria the existence of a government-owned monopoly personal-injury insurer is a major road safety strength.

Jurisdictions should review injury insurance arrangements in their State. There will always be opportunity for the companies to invest further in safety, either in behavioral programs (education and enforcement) or infrastructure or through encouragement via pricing signals to consumers encouraging, for example, the purchase of safer vehicles. The commercial benefits and short payback periods for appropriate investments are substantial.

Finding ways to address the community interest and still protect individual freedoms remains a delicate balancing act which is of critical importance to road safety achievement as much as the desire for continued political tenure.

Ministers and other government leaders depend on timely, quality advice in order to display committed leadership. This in turn is an important reinforcing influence for the professionals in the road safety agencies in devising and proposing effective (while also potentially challenging) policy changes and initiatives. This crucial interdependence, and its importance in further strengthening the likelihood of successful introduction of initiatives, needs to be better understood. Skilled ministerial advisers, with knowledge of the subject can be pivotal to success.

The important role of agencies in providing operational advice on a daily basis—both proactively and reactively—to support their Ministers' public positioning as a road safety champion, and, therefore, to better inform the public debate, also needs to be more widely recognized. These are important issues in developing capability to achieve road safety improvement in the US states.

Clearly a secure Government at an early stage in the electoral cycle will be more confident about making contentious decisions. Policy recommendations need to recognize this.

Adopting a safe system approach and a strategy with targets

The community is confronted by road safety in many and varied ways, often through media responses to more unusual crashes, multiple fatalities, and so on. So often the public response to crashes (the great majority of which involve a range of complex factors) is to blame the victim. Sometimes this may have some justification, but often, fatal crash outcomes depend upon a number of factors which interact and lead to death. We need to consider the role that all the

elements play in a fatal outcome—the road and roadside, the vehicle, the speed limit, and behavior of the road users involved.

A logical framework which examines these road safety elements and their interactions is essential to enable practitioners to develop their thinking and understanding around risk and countermeasure possibilities. It is also of vital assistance in providing more readily understood explanations of road safety risks and their potential treatment to the wider community.

The safe system approach provides this framework. It is derived from the work of the Swedish Road Authority and Road Safety Agencies in the Netherlands and has been adopted as the basis for road safety activity in Victoria, Australia since 2003. It is also adopted across Australia in the current National Road Safety Action Plan.

What is the safe system approach?

As road users are human, crashes are always likely to happen, even though there is a continuing focus on prevention. The safe system approach recognizes that there are limits to the capacity of the human body to survive various crash types above certain speeds of impact. It places a priority on systematically addressing major factors involved in specific crash types to achieve substantial road trauma reduction benefits over time.

The safe system approach aims to minimize the severity of injury and is based on the premise that road users should not die because of system failings.

The basic premise for survivability is that in the case of a five-star driver (obeying the law), in a five-star vehicle and driving on a five-star road and roadside with a five-star speed limit for the risk on that section of road, any road user in or outside the vehicle should not—if they or the driver make a simple mistake or error of judgement—be subjected to a crash in which they lose their lives.

It assumes that:

- crash analysis and ongoing development of better understanding of crash causes in a very broad sense is a mainstream and continuing activity of road safety agencies.
- adequate road rules to provide safe travel and the necessary enforcement of those rules to achieve high levels of compliance are in place (both areas of great opportunity).
- an adequate licensing system exists.
- an informed and aware community is very supportive of the settings required to achieve and maintain an increasingly safe road transport system.

It challenges “system designers” to achieve a balance in the three key factors on the physical network—the road and roadside safety, the travel speed as influenced by speed limits, and the primary and secondary safety features of vehicles in order to achieve safe conditions, which result in nonfatal crash outcomes.

However, it also anticipates that there are many other “system designers”—beyond the road and vehicle engineers—who impact on use of the network—and who also carry a major responsibility for these safer, survivable outcomes.

Some examples include the legislators/regulators/enforcement agencies who are expected to identify unsafe, but currently legal behaviors, and convince the public and elected representatives over time to implement new compliance measures to create a safer operating system for road users; the employers providing vehicles—both light passenger and heavy commercial—for use by their staff and requiring a range of driving tasks as part of employment contracts; the road trauma agencies providing onsite and hospital care; the licensing authorities seeking to improve the safety of drivers when licensed; and the road safety agencies, road users themselves, and local road safety groups in the community who provide public education and information (effectively the "users manual" guidance) for operating within the system.

Measures associated with improved compliance are a challenge. Extensive research studies have demonstrated that inappropriate speeds, including speeding, are major factors in crash risk and severity of crash outcomes and that small reductions in mean travel speeds will result in substantial reductions in fatalities. For example, in a 60 km/h zone, a 1% mean travel speed reduction (i.e., 0.6 km/h) will reduce fatalities on that section of road by some 4%!

Victoria has introduced a raft of measures to lower travel speeds and bring them closer to posted speed limits across the whole road system and the reductions in fatalities which occurred concurrently with these measures have been substantial, reflecting research predictions.

But issues such as speed enforcement and speed-limit reductions remain highly contentious. They run foul of strong desires by many not to slow down, and the notion of reducing risk by reducing speeds (usually by small amounts) is often greeted with trepidation at the political level. It leads to limited interventions with, for example, 10 km/h enforcement tolerances on speed limits permitted by many enforcement agencies (that is, for example, a 60 km/h limit really means 70 km/h) and reliance on installation and operation of highly conspicuous speed cameras rather than covert mobile camera use. This certainly reduces crashes at those fixed locations, but it also advises motorists where speed enforcement is unlikely to be carried out (everywhere else). Why is there such reluctance to introduce "anywhere, anytime" speed enforcement, at tougher levels, when so many lives could be saved? How can a developed society endure three or so drivers in every 100 breaking the enforced speed limit at any time and endangering the other 97 users? Why are the tabloid and "shock jock" media allowed to peddle wild assertions about speed and risk without challenge? This is an extreme failure at the political and operational enforcement level in many jurisdictions.

There are thoughtful ways to educate the public about the benefits of these programs over time and in advance of action. Proponents of change need to develop and implement a considered public awareness strategy with strong advocacy if they are to progress. A high level of implementation skills is necessary.

In applying safe-system thinking in practical terms, the major crash types in a jurisdiction are analyzed to consider what measures of targeted on-road infrastructure, vehicle safety features, speed limit, and licensing and behavioral compliance measures can be introduced to reduce the frequency and severity of that crash type.

For example, in Victoria, the major crash types have been run-off-road hit-object, side impact at intersections, pedestrian crashes, and head on crashes.

The safe system approach assists countermeasures for these crash types to be identified that will achieve a synergy if introduced over the same time frame. For example, to address side impact

crashes at intersections, countermeasures to be introduced could include provision of round-abouts or improved traffic signalization, introduction of skid-resistant road surfacing, encouragement of buyers to demand increased presence of head protecting side curtain airbags in their vehicles, and the adoption of a lower speed limit through intersections (to reduce side-impact speeds below the critical 50 km/h level for this crash type). These measures would, individually, reduce crash outcome severity. In combination, the outcomes in terms of crash reduction over time would be very much greater.

Put simply, the safe system approach leads to a focus of effort and investment on those components of the system that require change in order to be forgiving of unintentional errors.

This is not to suggest that all the answers are known! We also, of course, need to continually ask: what can be done (and what would a community be prepared to do) to address unacceptable, unsafe behaviors by the few on the network which impact on the majority of responsible road users?

This includes for example impaired driving (alcohol, drugs, and fatigue), speeding, not selecting an appropriate speed for the conditions, and not obeying road rules. We also need to continue to find ways to reduce the risks that face young, novice drivers in their first year of driving. How can we better understand and counter driver distraction?

The safe system approach is aspirational.

It seeks over time (perhaps over 20 to 30 years or more) to create a safe operating road and street transportation system in which avoidable deaths and serious injuries are prevented.

Introduction of a safe system approach provides a powerful platform for development, adoption, and implementation of a road safety strategy.

Why is a road safety strategy necessary?

In developing a road safety strategy for the longer term, it is important to have a vision of where a jurisdiction would like to be by the end of the planning horizon and a clear understanding of how its achievement would be recognized.

In pursuit of this vision, the focus will be on building institutional capabilities in transport, health, education, and justice sectors and creating the supporting partnerships within central, regional, and local government, communities, nongovernmental organizations, and the private sector that are critical to achieving positive and sustainable results.

It is suggested that a suitable vision could be:

> **“Within 15 years,…(the nominated states)...will build a robust road safety management system that produces best practice road safety outcomes on a manageable and sustainable basis.”**

How can this be realized? A critical element is the preparation of a strategy and action plan by the road safety agencies working together and its subsequent adoption by government.

Victoria has implemented many countermeasures since 2001 in accordance with its “*arrive alive, 2002–2007”* road safety strategy, strongly influenced by the adoption of safe system thinking in mid 2003.

The strategy was based on independent estimations of the likely road safety impacts of various countermeasures; it was placed before the public for meaningful consultation as a draft, adopted a target of a 20% reduction in fatalities and serious injuries by 2007, was signed by the three relevant Ministers, and launched as a public document by the Premier (Governor). A strategy in the development phase becomes the focus for dialogue within and beyond government and provides for the crucial understanding of what efforts and measures are required and are inherent in a strategy which has a particular target for trauma reduction as an outcome. It is, in short, a reality check and the basis of an informed conversation for all involved.

With a strategy that has necessary achievable stretch in the targets it sets and which addresses all the major issues (there are 17 major areas of challenge in "arrive alive"), any government has a powerful public policy basis for—and clear commitment to— implementation, albeit, in a patient and thoughtful manner.

Social contract approach

How can a "social contract" approach be developed with the community seeking to (a) improve road safety through promoting complementary roles with government and (b) highlight prevailing cultural settings including the reinforcing influences in the community which tend to block opportunities for road safety improvement?

A first step is to encourage recognition by the public of those existing cultural and attitudinal settings and "accepted" views that compromise road safety improvement.

The public should also be encouraged to be active participants in the policy dialogue. The "social contract" concept is based on mutually supportive efforts by all system designers, operators, and users and encourages the community to commit to a safety culture which seeks improved road safety in areas they can influence in the various roles, including: road users, employers, community group members; and consumers. The road safety agencies for their part would commit to moving over time to a safer road transport system through improved infrastructure standards, risk-adjusted speed limits, vehicle safety, legislative, enforcement, and public information measures.

This is not a trivial task and will require considerable effort on the part of the road safety agencies in particular, to provide best practice guidance in areas such as:

- Heavy-vehicle safety policies and targets
- Acceptable vehicle advertising by manufacturers
- Community and local government road safety promotion programs
- Risk-reduction strategies for novice and older drivers
- Power pole location policies of utility companies
- Licensed premises operator policies for responsible serving of alcohol
- Speedometer redesign by manufacturers

- Limiting the power/maximum speeds of light passenger vehicle engines
- Drivers limiting travel when influenced by fatigue and low-level alcohol (i.e., less than legal limits)
- Company vehicle and driving safety policies for employees.

There is a fundamental need to seek useful ways to encourage public understanding of the relative risks of individual travel on a length of road, what factors contribute to that risk and to increase public support for implementation of measures to improve safety on the higher-risk road sections. Road safety agencies need to be, and be seen to be, continuously engaged in identifying and responding to risks.

How can consumer activity be supported in the areas of vehicle and road/roadside safety to increase demand for improvements by the providers?

The promotion of the New Car Assessment Program (NCAP) will continue to be an important consumer information activity. It is a valuable national program which would benefit from local promotion of the advantages of safer vehicles (and specific safety features) to inform the public and increase consumer demand for those features. The US has, of course, led the way with its strong focus on vehicle safety and infrastructure investment, often benefiting safety.

The extent of trauma reduction which can be achieved through more rapid introduction of safer vehicles into the fleet is substantial. It is not sufficient to wait for drawn-out and, perhaps, controversial regulatory change. Road safety agencies should foster consumer demand for safer vehicles now as a priority and press automakers to offer these new features as standard or at least as unbundled options. New features, such as electronic stability control, head protecting curtain airbags, and other active and passive safety improvements are providing very substantial safety benefits.

However, the picture in terms of actions to address higher-risk behaviors is quite dismal. The notion that individual behavioral freedoms should outweigh risks to other road users, including passengers in the same vehicle, is increasingly unacceptable in Victorian society. It is not considered acceptable for individuals to argue that they are entitled to do as they please on the roads in pursuing their freedom of expression. Their unsafe behaviors impact upon other road users, either as a result of a crash or as a result of the poor role models they are for younger citizens by not supporting responsible harm minimization strategies such as wearing seat belts and helmets on motorcycles.

There is a great benefit in fostering an informed and involved community, active in its dialogue about road safety matters and willing to be an active participant in road safety improvement. Widespread availability of relevant, simply expressed, but forceful, factual material is a crucial part of promoting and achieving a social contract approach, as is the disarming question, “What are you prepared to do to improve road safety in your community?”

There are many potential benefits in better understanding the driving forces behind public and media interest in road safety. There is a long history in many places which would be instructive in anticipating likely concerns and issues and in making available high quality, relevant resource material. Seeking to lead the debate with many aligned contributors, rather than finding themselves in a reactive position is an important issue for the road safety agencies. The resource implications associated with such an intention would, of course, require careful consideration. Involving the community in debate about current risks and future solutions and fostering their

support are threshold activities for agencies. Improved ways and means of informing, involving, and empowering stakeholder and community groups need to be developed. It does require some courage and leadership to publicly articulate the road safety message—but that is the task requirement.

It is not necessary, or indeed feasible, to legislate for all required or desired behavioral changes in the short term. A proven approach for the medium term is to educate and promote to the public desired behavioral changes over a period of some years, engaging the community in debate. When or if the measure can be regarded as an accepted maxim for the bulk of the community, governments can move in a far less contentious environment to introduce the provisions as legislation or regulation, cementing the safety benefits in place.

We must ask the question: how do states in the US currently address these issues?

The opportunities to reduce the deaths of Americans on the US road network each day are substantial.

Can the community be motivated to seize these opportunities?

Recommendations

(1) Comparison of changes in absolute fatality levels in the United States and Australia (and Victoria) between 1995 and 2003 is instructive. The number of persons killed in road crashes in the United States has increased by 2 percent in those nine years. In contrast, the number of persons killed in Australia has decreased by more than 20 percent in the same period and by 21% in Victoria. Australian agencies followed a model of corporate leadership and management techniques embracing the safe systems approach. There is a need to recognize and pursue the major opportunity that exists to reduce deaths of Americans on American roads.

(2) The FHWA Scan Team examining Transportation Performance Measures in Australia, Canada, Japan, and New Zealand in 2004 included in their recommendations…"The most integrated and impressive application of a performance measurement framework the scan team observed was in the area of safety. The team believes that the Australian model and the significant results achieved in the safety area are worthy of sharing and ultimately implementing in the United States.

Two safety implementation strategies are recommended:

1. Bring Australian safety leaders to the United States to tell their story to key groups.
2. Encourage states to implement the best practices learned.

This recommendation is endorsed.

(3) Develop a pilot road safety implementation program in, say, two groups of three US states and negotiate application of as much of the relevant elements of the "Victorian" approach as is feasible. Implement over a five-year period, monitor and compare outcomes, and promote successes.

(4) Mechanisms by which governments and communities can achieve improved road safety outcomes are not well understood and have received little research attention. Identify and under-

stand those principles and processes which will assist change to achieve community acceptance over time of new countermeasure proposals. Proponents of change need to be well equipped if their ideas are to negotiate the difficult course of public debate and bring about greater acceptance (albeit, often incrementally) in public attitudes.

(5) Based on the Victorian experience with raising government and community risk awareness, the following four critical areas of new thinking are recommended as offering particular promise for research (as pilot implementations) for changing the traffic safety culture in the US.

These critical areas are:

1. Performance measurement
2. Effective leadership, management, and co-ordination
3. Adopting a safe system approach and a strategy with targets
4. Promoting a social contract approach

Performance measurement

(6) Resolve to conduct analysis of the data and publish it widely within the road safety agencies and departments. The purpose is to have the data presented in such a way that it "speaks for itself" and contributes strongly to driving debate and discussion about trends, progress, and further countermeasures. North American road safety would benefit from this much more proactive approach to data awareness.

(7) Develop a preparedness to measure detailed performance by assessing road trauma levels against other jurisdictions—nationally and internationally—to ensure that practitioners "better know their business." It can also provide a reality check at the senior executive and political levels and encourage further development of proposals to improve that jurisdiction's relative position.

Effective leadership, management, and co-ordination

(8) Seek to introduce a "ministerial cabinet" committee for road safety in your State, comprising key Secretaries (e.g., transportation, police and health, or justice), recognizing that it is a critically important mechanism to achieve strong representation for road safety initiatives at the Cabinet table and to deal with the political trade-offs so often involved in the introduction of road safety measures, such as mobility, environment, privacy, and civil liberty or public safety impacts.

(9) Governments should provide effective leadership and implement appropriate arrangements for management and co-ordination of road safety activity including:

- building institutional capabilities in transportation, health, education, and justice sectors.
- providing clear statements of required outcomes (through a strategy plan, actions, and agreed targets).

- definition of collective and individual accountability, supported and reinforced by management and reporting structures.
- requiring a "joined-up Government" partnership of agencies, focussed only on "the plan," willing to share success, recognizing the roles and contributions of the participants and sharing leadership.
- creation of the supporting partnerships within central, regional, and local government, communities, nongovernmental organizations, and the private sector that are critical to achieving positive and sustainable results.
- requiring one consolidated reporting framework to government by the agencies.

(10) While government strategies and agency actions should focus on implementing actions that deliver certain benefits, thoughtful analysis is recommended to guide initial efforts to those countermeasures where political and community support can be more readily achieved and which can be delivered in the desired time frame.

(11) Recognize that high standard organizational knowledge, capability, and commitment—applied in a patient manner—is critical if policy proposals are to be soundly developed, regarded as credible and achieve support by governments. Move to develop public acceptance that government intervention is essential to address certain issues in a society—including road trauma reduction—as a prerequisite for building public understanding and support for action.

(12) Senior staff in the road safety agencies require a strong grasp of relevant community attitudes and aspirations and a comprehensive understanding of the requirements of public policy debate, including media relations. Ensure that the impacts of proposed policies on activity other than road safety that may be considered adverse are actively addressed and constituencies engaged.

It is also crucial that there is a realistic and hardheaded awareness of likely acceptance by the public of policy measures under consideration, certainly in the short to medium term. This requires the presence of experienced campaigners in the senior agency roles and implies that sufficient incentives exist within the public sector to retain key competent people.

(13) Require the development of an objective methodology linking interventions to outcomes, based on research assessments, local evaluation of previous intervention programs and based also on local conditions, as the basis for consideration and adoption of targets.

(14) Utilize approaches which optimize the likelihood that measures survive the policy development and public response phases. Staged introduction or substantial education programs over one or two years before legislative initiatives are introduced are typical methods available to increase successful passage down the implementation pipeline.

(15) Ensure there are a range of independent inputs to the public debate about road safety issues (beyond government). This is necessary to win public support for the development and introduction of policies and actions. Some of these potential inputs could include bipartisan legislative committees (such as the all-party Victorian Parliamentary Road Safety Committee), independent credible research organizations, and other safety advocates (individuals and groups).

(16) Review road crash injury insurance arrangements in your State. There will always be opportunity for the companies to invest further in safety, either in behavioral programs (education and enforcement) or infrastructure or through encouragement via pricing signals to consumers, for example, for the purchase of safer vehicles. The commercial benefits and short payback periods for appropriate investments are usually substantial.

(17) Legislators depend on timely, quality advice in order to display committed leadership. This, in turn, is an important reinforcing influence for the professionals in the road safety agencies in devising and proposing effective (while also potentially challenging) policy changes and initiatives. Recognize and develop this crucial interdependence, and understand its importance in further strengthening the likelihood of successful introduction of initiatives. Skilled legislative staffers, with knowledge of the subject, can be a crucial component for success.

(18) Recognize the important role of agencies in providing operational advice on a daily basis—both proactively and reactively—to support their legislators' public positioning as a road safety champion informing the public debate.

Adopting a safe system approach with targets

(19) Adopt safe system thinking in your state, recognizing that:

> The safe system approach is aspirational and seeks over time (perhaps, over 20 to 30 years or more) to create a safe operating road and street transportation system in which avoidable deaths and serious injuries are prevented.
>
> - The approach provides a powerful platform for development, adoption, and implementation of a road safety strategy.
> - It requires the major crash types in a jurisdiction to be carefully analyzed to consider what measures of targeted on-road infrastructure, vehicle safety features, speed limit, and licensing and behavioral compliance by road users can be introduced to reduce the frequency and severity of that crash type.

(20) It is suggested that an appropriate strategic safety vision for States in the US could be:

> **"Within 15 years,…(the nominated states)...will build a robust road safety management system that produces best practice road safety outcomes on a manageable and sustainable basis."**

(21) Develop a road safety strategy and action plan. A strategy in development becomes the focus for dialogue within and beyond government and provides for the crucial understanding of what efforts and measures are required to achieve a desired target for trauma reduction. It provides a reality check for all involved but is also a vehicle to build community understanding of the issues.

Promoting a social contract approach

(22) Promote recognition by the public of those existing cultural and attitudinal settings and "accepted" views that compromise road safety improvement as a first step in developing a social contract with the community.

(23) Encourage the public to be active participants in the policy dialogue. The "social contract" concept is based on mutually supportive efforts by all system designers, operators, and users and challenges the community to commit to a safety culture which seeks improved road safety in areas they can influence in their various roles, including: road users, employers, community group members, and consumers.

(24) Find ways to encourage public understanding of the relative risks of individual travel on a length of road and what factors contribute to that risk and to increase public support for implementation of measures to improve safety on the higher risk road sections. Road safety agencies need to be, and be seen to be, continuously engaged in identifying and responding to risks.

(25) Recognize the challenges inherent in changing community perceptions and in winning support to address higher-risk behaviors. Such challenges include the notion that individual behavioral freedoms should outweigh risks to other road users, including passengers in the same vehicle, and the notion that individuals are entitled to do as they please on the roads in pursuing their freedom of expression. Their unsafe behaviors impact upon other road users, either as a result of a crash or as a result of the poor role models they are for younger citizens, in particular, by not supporting responsible harm minimization strategies, such as wearing seat belts and helmets on motorcycles. These attitudes need to be addressed.

(26) Seek to have the road safety agencies lead the public debate on risks and countermeasures with many aligned contributors, rather than finding themselves in a reactive position.

References

Anderson, D., and E. Howard. 2005. *Sustaining improvements in road safety outcomes*, Australasian Road Safety Research, Policing and Education Conference, Wellington.

Auditor General Victoria. 2006. *Making travel safer: Victoria's speed enforcement program*, July 2006. http://www.audit.vic.gov.au/reports_par/agp116cv.html.

Australian Transport Safety Bureau (ATSB). 2004. *Draft National Road Safety Action Plan 2005–2006*.

Farmer, C. M. 2004. Effect of Electronic Stability Control on Automobile Crash Risk, *Traffic Injury Prevention* 5:317–25.

Howard, E. 2003. *Speed and death: An assessment of the practical application of research predictions regarding urban speeding*, Australasian Road Safety Research, Policing and Education Conference. Sydney.

———. 2004. *Implementing a 'Safe System' approach to road safety in Victoria.* Australasian Road Safety Research, Policing and Education Conference. Perth, W.A.

Johnston, I. R. 2004. Reducing injury from speed-related road crashes—towards the achievement of a population-based prevention strategy, *Injury Prevention* 10 (5): 257–9. [Guest editorial]

———. 2006. *Halving deaths from road traffic crashes: A case study from Victoria, Australia, 1989–2004*, US DOT Federal Highway Administration.

VicRoads. 2004. *Victoria's Vehicle Safety Strategy 2002–2007*.

Biographical statements

Eric Howard was General Manager—Road Safety with VicRoads from 1998 to 2006. He was responsible to the Ministerial Road Safety Council for development of Victoria's road safety strategy "*arrive alive—2002 to 2007*"—and for many road safety policy initiatives—in association with Victoria's road safety partners, including infrastructure standards; new safety programs and treatments; comprehensive speed management; public promotion of safer vehicles; legislation for random roadside saliva based drug testing of drivers and for introduction of alcohol interlocks; tougher penalties for speeding, drink driving and other offences; introduction of road safety partnership programs with local government and development of policy for expanded graduated licensing measures. "*arrive alive*" has been a successful strategy and the targeted fatality reductions of 20% have been achieved.

Eric has provided strategic road safety advice to Australian and international jurisdictions in recent years, particularly about the benefits of a "safe system" approach to road safety, adopted in Victoria from 2003. He has presented regularly to Victorian and Australian Parliamentary Road Safety Committee Inquiries.

Prior to taking up the appointment with VicRoads, Eric was an experienced senior manager in local government in Victoria, most recently as Chief Executive of the Shire of Yarra Ranges in eastern Melbourne—appointed at the time of major local government amalgamations in 1994—following five years as Corporate Manager and Acting Chief Executive of the City of Melbourne and other Senior executive management roles in Victorian Local Governments for more than 20 years.

Eric established his own consultancy—Eric Howard and Associates—early last year to provide strategic road safety advisory services, internationally and within Australia. Recent projects include guidance for the new draft Victorian road safety strategy for the Victorian Government; Reviews of road safety management capacity for the World Bank in Ukraine, Armenia, and currently Bosnia and Hercegovina; an ongoing midterm Review of the Canadian road safety strategy; strategic road safety projects for the Australian Road Research Board and VicRoads; leading the development of the Speed Management Manual for the Global Road Safety

Partnership and a continuing role on Vicroads behalf as Chair of the OECD/ECMT Working Group examining "Achieving Ambitious Road Safety Targets", to report later in 2007.

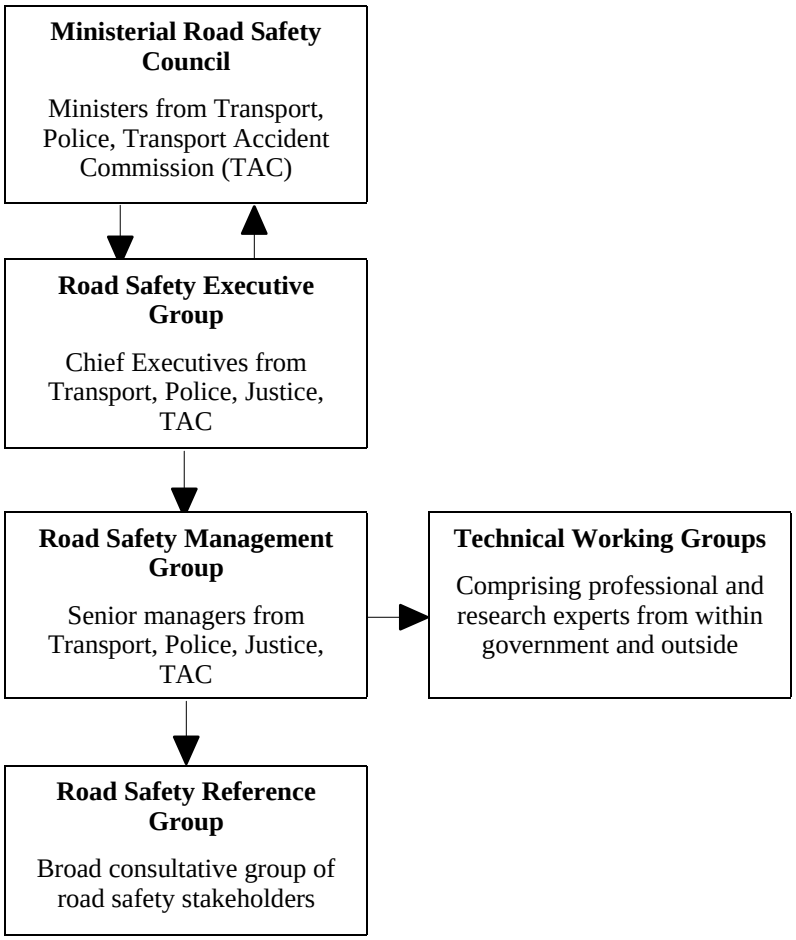
Eric was a Member of the Board of the Monash University Accident Research Centre, a Director of the Driver Education Centre of Australia, a member of the National Road Safety Strategy Panel and Chair of the Victorian Road Safety Reference Group. His contribution to road safety improvement in Victoria was recognized in 2005 by the Victorian Parliamentary Road Safety Committee and the Minister for Transport.

Dr. Peter Sweatman was appointed Director of the University of Michigan Transportation Research Institute (UMTRI) in September 2004. He came to UMTRI after a long career in transportation research and development in his native Australia, and with extensive international connections.

Dr. Sweatman is an acknowledged international leader in the scientific field of heavy commercial vehicle interaction with the infrastructure and built a successful freight technology innovation business. He has a strong interest in advanced safety systems which help drivers to avoid crashes, and in communication technology which will not only prevent crashes but also improve traffic flow. He is active in a number of TRB committees, the Ford Global Citizenship Review Committee and the University of Michigan Energy Research Council.

In Australia, Dr. Sweatman's achievements were recognised in being elected a Fellow of the Academy of Technological Sciences and Engineering in 1997 and in being awarded a Centenary Medal in 2002 by the Prime Minister of Australia—*For Service to Australian Society in Transportation Engineering*.

Figure 2. An organizational model for multi-sectoral governmental coordination in road safety —Victoria, Australia.



The Ministerial Road Safety Council meets 4 times each year to ensure a coordinated approach to road safety. It can provide a powerful voice in cabinet for the pursuit of road safety policies, funding of new initiatives including legislation. The Chair is rotated at each meeting. The group signs off the road safety strategy based on detailed methodologies for established likely outputs by the main stakeholders for certain key policy initiative inputs.

The Road Safety Executive Group reports to, supports and receives direction from the Ministerial Council. The Group determines strategic directions, monitors and reports progress to the Government through the Ministerial Council. The Group meets approximately four times each year and the Chair rotates between agencies.

The Road Safety Management Group is the hub of the road safety co-ordination—meeting monthly. The Chair rotates between agencies. With the lead agency as the key link, the group coordinates implementation of the road safety strategy, develops and implements programs and countermeasures, reviews identified programs, identifies research priorities, promotes a coordinated statewide program of activities, supports development and implementation of educational initiatives including the Traffic Safety Education Action Plan and links with the State Trauma System.

The Road Safety Reference Group is a consultative body comprising all the main road safety stakeholders including the nongovernmental sector which meets quarterly and is chaired by the lead agency head of road safety.

A case for evidence-based road-safety delivery

Ezra Hauer

Overview

A change from a system of road-safety delivery rooted in opinion, intuition, and folklore to one that is founded in science and based on factual knowledge is underway. Change, as always, faces obstacles. The main obstacle is the near absence of professionals who can be the carriers and providers of factual road-safety knowledge. The second important obstacle is the weakness of the knowledge in which these professionals would have to be trained. Both obstacles stem from the same source; in a society in which it is acceptable to deliver road safety on the basis of opinion, intuition, and folklore, there is little demand for factual knowledge and for carriers thereof. Therefore, the most urgently needed change of road-safety culture is to make intuition-based road-safety delivery socially unacceptable. Much of the present content is based on an earlier paper (Hauer 2005).

The uncertain trumpet

The *Safety Culture Backgrounder* (March 30, 2006) placed on the web by the Foundation puts it bluntly: First, that it is not acceptable for 40,000 Americans to die on the road year-after-year. Second, that the customary lip-service response to bad publicity will not get us very far. Third, that a change in safety culture is needed. The culture to be changed is of the "collective acceptance of and/or complacency over the toll of crashes"; the change is "to elevate the place of traffic safety on the national agenda ... and motivate U.S. decision makers and motorists to acknowledge traffic safety as a legitimate priority."

Suppose for a dreamy moment that the motorists made their desire for change forcefully known, and that, as a result, top decision makers made road safety a much higher priority. In this dream, there is now more money for road safety. What would we do with the money to reduce the present toll of crashes? Should we put more police on the road? Add lanes to reduce congestion? Reduce speed limits? Convert signals to roundabouts? Educate children on safety? Test the road skills of seniors? Put high-tech stuff into cars? Subsidize rail to reduce trucking and buses to reduce car use? Provide bicycle lanes? Build subways to diminish exposure? Do more research?

One can always find ways to spend public money. The two questions are: whether the money can be spent effectively, and whether spending it will bring about a substantial reduction in fatalities. Experts are likely to differ in their opinions about the efficacy and relative merit of the aforementioned countermeasures as well as of many others. They will find it very difficult to estimate what accident savings will ensue if the money were spent on what they might suggest. This is a reflection of the poverty of knowledge in the road-safety delivery field, not of a peculiar fractiousness of road-safety experts. Surely, this is a problem. I cannot imagine the medical profession arguing for the introduction of a treatment of unknown efficacy or a pharmaceutical company asking for the approval for a drug of unspecified effectiveness. Unfortunately, in the delivery of road safety, we sound a very uncertain trumpet and "...if the trumpet give an uncertain sound, who shall prepare himself to the battle?" (1 Corinthians 14:8).

This brings me to crux of the argument. It is true that to bring about a substantial reduction in the toll of crashes requires money. It is also true that to secure such money requires the raising of the road-safety profile amongst road users and amongst those who hold the purse strings. These are the two strands of safety culture on which the *Safety Culture Backgrounder* seems to focus. Yet, remember, to build a decent bench takes both lumber and a skilled carpenter. Similarly, to reduce the toll of crashes takes both money and also persons who know how to reduce crashes effectively. At present, we have little substantive knowledge, and very few people are trained in fact-based road-safety knowledge. The prevailing culture is to think that while one must apprentice in carpentry, road safety can be delivered on the basis of opinion, folklore, tradition, intuition, and personal experience. This, I believe, is the strand of culture in urgent need of change. Without such a change in the prevailing safety culture, much money goes to waste. The shift from a system of road-safety delivery rooted in opinion, intuition, and folklore to one that is founded in science and based on evidence requires a profound cultural change. Such a change, as will become clear, will take not only a substantial amount of money but, primarily, much top-level resolve.

The road-safety delivery system

It will help to be clear about what is meant by "road-safety delivery system." If one tries to describe the health-delivery system, what comes to mind are the physicians, nurses, lab technicians, and pharmacists; the textbooks, libraries, and schools where they all are trained and certified; the clinics, hospitals, and medical centers where they work; the industries that develop pharmaceuticals or build the instruments and machines used by health-care professionals, etc. Were one similarly trying to describe the road-safety delivery system, the evident elements would be few. One might list the police officers on traffic duty, the driving instructors and those who test and license drivers or vehicles, perhaps, organizations such as the NHTSA or the MCSA, and a few safety research centers. Beyond these, the system becomes diffuse. Large parts of it overlap with other systems and are difficult to demarcate. There are the highway designers, traffic engineers, urban planners, the municipal planning departments, the state DOTs, the motor vehicle manufacturers, the transport regulators, etc. All these actors affect road safety "by the way", as a side product of their main mission. Because it is so diffuse, it is useful to think of the road-safety delivery system as consisting of *all those actors and actions that significantly shape the future number and severity of crashes*. This, in turn, makes it necessary to declare who determines the future number and severity of crashes and how.

The traditional view is to think of road safety as the problem of bad behavior (drinking, speeding, reckless driving, etc.), bad roads (poor pavement friction, short sight-distances, illegible signs, accident blackspots, etc.) ,or, perhaps, of bad vehicles (unstable trucks, high center-of-gravity SUVs, worn or exploding tires, etc.). This view logically leads to the opinion that the road-safety delivery system consists of those actions and actors the aim of which is to reduce bad behavior, to rectify bad roads, and to improve bad vehicles. I think that this view is too narrow as it encompasses only a very small portion of actors and actions that significantly shape our safety future.

From a broader perspective, the number and severity of future crashes is determined by:

- The future amount of trip making (how many trips, how long).

- The future mode of travel used (on foot, by bicycle, as a rider in public transport, in a private car) and by the mode of goods transport used (car, air, truck, rail).
- The kinds of infrastructure on which this travel and transport will take place (e.g., road class, access control, intersection density, road design and traffic control, subway, etc.).
- The future vehicles and technology in use.
- The demography and norms of behavior of the future, as well as the usual human abilities and frailties.

From this perspective, it follows that those who by their plans, designs, and decisions influence the future amount of trip making and its mode, those who shape the details of the infrastructure, the vehicles, and technology in use, and those who mold the norms of behavior also determine the road-safety future of a society. The corresponding list of professionals and decision makers should include not only the law enforcement officers, driver educators, highway designers, and traffic engineers whose role in safety is clear. Because the amount of travel and its mode depend on land use, policy, budgets, taxation, regulation, and similar factors, the list should also include town planners, architects, municipal engineers, transportation planners, economists, officials on planning boards, officials who approve planning and design documents, etc. The actions and decisions of all these jointly determine how many would be killed or injured in crashes and how much property would be destroyed. It follows that progress in road-safety delivery depends on the job done by those whose actions and decisions shape the road-safety future.

About progress

To convey an impression of where the road-safety delivery system now is and a sense of the direction in which it is moving, Figure 1 describes two prototype styles of road-safety delivery to demarcate two ends of a scale.

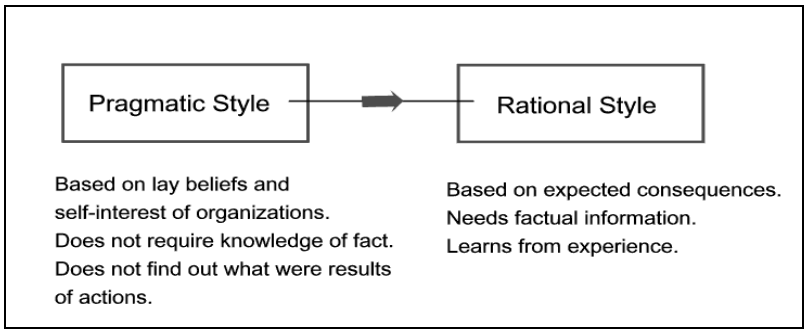


Figure 1. Two styles road-safety delivery systems

The *pragmatic style* rests on beliefs about road safety and on the nature of organizations. These beliefs may pertain to the efficacy of police enforcement, the importance of stricter laws and firmer punishment, the need for better driver education and more stringent driving tests, etc. The

nature of organizations pertains to their need to cater to what is popular, to demonstrate concern, to show initiative, or to maintain budget, influence, manpower, income, etc. There is no intent to claim that any real organization practices the pragmatic style. However, if one did, then those in its employ would not really need to know facts about road safety, other than facts about what the widely held beliefs are and what is popular. The organization would have no use for research other than the research of public opinion. There would be no real reason to ascertain what the safety consequences of any initiative were, except if they were useful for public relations.

The *rational style*, in contrast, is rooted in the desire to reduce the harm of crashes efficiently. Here the essence is the ability to foresee the road-safety consequences of decisions and actions, to ascertain their costs, and to balance costs and gains. Again, perhaps no real organization behaves in this manner. However, if one did, people in its employ would need to possess and use existing factual knowledge, and the organization would make sure that the results of important interventions are evaluated so as to learn from experience.

Where on this scale is the operation of a real actor or organization can be ascertained by asking a few questions: (1) Do the actor or the organization require that extant factual knowledge about the safety consequences of decisions be ascertained? (2) Do the actor or organization employ or buy advice from people who have been trained in and have acquired factual knowledge about road safety? (3) Do the actor or organization engage in evaluative research to learn about the success or failure of its actions? If the answer to these questions is **NO**, the style of the actor or organization is close to being pragmatic.

In these questions, the phrase *factual knowledge* was used. A brief clarification of its importance and meaning is in order. Intuition and experience are fallible guides to road-safety delivery. Just as one cannot tell by intuition or experience whether aspirin reduces the chance of a heart attack, so neither intuition nor personal experience can tell one by how much widening lanes, more speed enforcement, or a new instrument on the dashboard will affect crashes. Only scientific research can do so. This is well accepted in medicine, education, and most similar fields. Thus, the phrase factual knowledge means:

> *Information accumulated by research that is based on data, measurement, and experiments and is extracted from these by defensible means.*

Instead of "factual" I could have used the now popular term "evidence-based." The Wikipedia (2006) states that: "*Using techniques from science, engineering and statistics, such as meta-analysis of scientific literature, risk-benefit analysis, and randomized controlled trials, it (evidence-based medicine) aims for the ideal that healthcare professionals should make 'conscientious, explicit, and judicious use of current best evidence' in their everyday practice*." Evidence-based medicine categorizes different types of empirical evidence and ranks them according to their strengths and freedom from bias. The best type of evidence is that obtained from properly designed randomized controlled trials, whereas the worst type is "opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees." Googling the internet for "evidence-based" shows more than 300 million hits, including "evidence-based toilet training," "evidence-based marketing," and "evidence-based hair removal." While the evidence-based phrase has obvious attraction, its currency has been somewhat devalued since the evidence-based bandwagon is already crowded and has some suspicious looking characters on it. On the other hand, the entirely respectable use of the phrase

in medicine sets a high standard by insisting on learning mainly from randomized controlled trials, a standard that is not really attainable in road-safety research. For these reasons, I elected not to use the "evidence-based" rallying cry (except in the title) and to stick into the text the equivalent word *factual*.

The factual knowledge I speak of is mainly about the link between action and its safety consequences. At present, such factual knowledge is weak. Here are a few examples: Highway engineers believe that safety is the foremost aim of their design procedures. Yet, the highway designer cannot say how many more crashes would occur if a curve were built to a shorter radius. For traffic engineers, the motto is "safe and efficient." Yet, the traffic engineer does not know how the choice of the signal cycle time affects crash frequency. Similarly, the urban planner has no knowledge about the relative safety of crescents and cul-de-sacs or about the relationship between arterial spacing and safety; the transportation planner does not know how to predict the safety effect of alternative plans or investment; safety is not quantitatively considered in municipal rezoning decisions or exit location; the state does not know what is the safety benefit of its demerit point system; the federal government does not know how truck size is related to safety; motor vehicle manufactures have difficulty predicting the safety effect of some new device, etc. At the personal level, the professional's concern for road-user safety is genuine. However, a fact-based link between proposed action and its safety consequences is not part of the professional's toolkit.

I taught traffic engineering, highway design, and transportation planning to civil engineers for twenty-seven years. Therefore, I can attest to the fact that civil engineers graduate from a four-year program and enter practice without being taught about the link between the design decisions they will make and the crash frequency and severity that will follow. Some will protest and claim that concern for safety is implicit in matters such as signal-timing procedures or geometric design standards; that adherence to the MUTCD (FHWA 2000) and the Policy (AASHTO 2001) will automatically ensure that a proper amount of safety is built into roads. Such a belief, while honestly and passionately held, is without foundation. The standards and warrants in the aforementioned documents are, by and large, the embodiment of opinion and personal experience—not of scientifically supportable fact. Having dealt with this issue at length elsewhere (Hauer 2000 a, b), this is not the place to repeat chapter and verse. But the reader can put the matter to a test. Does the Policy (AASHTO 2001) tell how many crashes would be saved if a larger radius were chosen? It does not. And yet, research (on two-lane rural roads) consistently indicates that the larger the curve radius, the fewer the crashes. In spite of overwhelming empirical evidence to the contrary, it is tacitly assumed that if a curve of a given radius is banked (super-elevated) in accordance with the Policy, the curve is appropriately safe. After testing the Policy in a similar manner on many issues, one will conclude that the Policy is the embodiment of tradition, judgment, intuition, and experience—not of empirical fact—and that the safety of roads designed by following the Policy is simply unpremeditated. As such, the Policy is a part of the pragmatic, not of the rational, style of road-safety management.

These views are confirmed in a recent scan of U.S.-based university courses in safety (NCHRP, 2006). The scan identified relatively few current offerings within engineering programs (29 of

117) and a comparable lack of coverage within public health programs (7 of 34). There is a prevalent view, even among university educators, that "good" design and operations, as described in professional guidebooks (such as the Policy and the MUTCD) will lead to quantifiable safety improvements. The relative lack of existing safety research material to provide a more fundamental and rigorous safety educational experience is a particular concern. This is not intended to criticize individual courses or universities, but rather to identify and shed light on an important educational deficiency that exists throughout the United States. While progress continues to be made in the development of better tools and analysis techniques for safety management, these techniques are absent in most university-based education programs. Perhaps more importantly, there are only a handful of universities that treat safety as a discipline in its own right, with principles and a scientific perspective underlying its practice and future development. It is unrealistic to assume that new, more effective strategies will be developed and implemented by professionals trained using old materials.

The line connecting the two prototype styles in Figure 1 has an arrowhead pointing to the right. My intention was to show that progress is away from the "pragmatic" and towards the "rational style" of road-safety management. That this is indeed the direction of change follows from four lines of reasoning. First, the history of humanity is the story of moving away from action based on intuition and belief and towards action based on fact-based knowledge and science. It would be extraordinary if the management of road safety bucked this universal trend. Second, once the intuitively obvious has been implemented, only reliance on knowledge, science, and technology holds the promise of reducing the toll of crashes effectively. Third, the legislation now requires that transportation plans and decisions at the state and metropolitan levels to take road safety into account more directly. In some states the explicit consideration of safety in major transportation projects is now standard. Fourth, many initiatives in the last decade point in the right direction: the *Canadian Geometric Design Guide* (TAC 1999), the Interactive Highway Safety Design Model software tool, the *Highway Safety Manual* now under development, the *AASHTO Strategic Highway Safety Plan* (AASHTO 1998) in implementation; the SafetyAnalyst (Harwood 2002) tool soon to be released, the specification of core competencies and safety workforce training requirements by a Transportation Research Board Committee (NCHRP 2006), and a future project (17-40) by the National Cooperative Highway Research Program serving a similar purpose, etc.

Here is a sum of the argument chain presented so far. I think of the road-safety delivery system as consisting of all those actions that significantly shape the future number and severity of crashes. This leads me to reject that parochial view limiting the scope of road-safety delivery to improving bad behavior, bad roads, and bad vehicles. I argued that our safety future is constantly shaped by many actors and mentioned some of their decisions and actions. Here I paused to describe the two prototype styles of road-safety delivery. My view is that the road-safety delivery is moving from the pragmatic style towards the rational style. In contrast to the pragmatic style which requires little factual road-safety know-how, the *kingpin of the rational style are persons in possession of factual knowledge enabling them to anticipate the road-safety consequences of decisions*. At present this kingpin is weak. This is the main obstacle to progress towards a rational road-safety delivery system. The recognition that this is the main obstacle is principal cultural change needed.

The strap of the boot

The question is how to bring into existence a healthy layer of professionals to be the carriers and suppliers of factual road-safety knowledge. Three conditions must exist:

1. There has to be sufficient factual knowledge.
2. There have to be the textbooks, teachers, and courses of study by which the factual knowledge is imparted onto trainees.
3. There have to be jobs in which the graduates make use of the knowledge they mastered.

All three conditions are necessary, and none now exist to a nearly sufficient extent. Therefore, as noted early in Section 1, substantial resources and much top-level resolve will be needed. Where to begin? The current weakness in all three conditions may suggest a bootstrapping approach. However, I believe that factual knowledge is sparse and training for professionals is sporadic because there is virtually no demand for the services of persons trained in road-safety. This is why the third bullet is the strap to be pulled on first and strongest.

On various occasions, mention was made of the health delivery system. While it's parallel with the road-safety delivery system is appropriate in a limited sense (both deal with injury and its prevention), there is one overriding difference between the two: there is a natural (some say unlimited) demand for health delivery services at the individual level while there is nothing of that sort for road safety. Without demand there is no supply. Ergo, no jobs for persons trained in safety; ergo, no need for courses, teachers, or textbooks; ergo, little use for knowledge created by research. In this respect the contrast between the delivery of road safety and the delivery of health is clear and stark; the difference is in demand!

The telling of a historical anecdote at this point is instructive.—From early on, traffic engineers learned to conduct travel surveys and think in terms of "origin-destination" tables and "trip desire lines." However, till the early1950s there was little of what could be called a "transportation-planning process" or a profession called "transportation planning." Change came in the fifties. As told by Weiner (1997), "an important cornerstone of the federal policy concerning urban planning was Section 701 of the Housing Act of 1954. The act demonstrated congressional concern with urban problems and recognition of the urban planning process as an appropriate approach to dealing with such problems. Section 701 authorized the provision of federal planning assistance to state planning agencies, cities, and other municipalities ... and ... to metropolitan and regional planning agencies." The source of congressional concern was with the efficiency by which federal money was being spent on transportation. Federal money was the carrot used to induce municipal governments to prepare transportation plans. But who knew how to do so?

Again according to Weiner (1997), "Prior to the early 1950s, the results of early origin-destination studies were used primarily for describing existing travel patterns, usually in the form of trip origins and destinations and by desire lines,' indicating schematically the major spatial distribution of trips. Future urban travel volumes were developed by extending the past traffic growth rate into the future, merely an extrapolation technique. ... Beginning in the early 1950s, new ideas and techniques were being rapidly generated for application in urban transportation planning." The need to prepare transportation plans quickly generated a supply of professionals who

knew how to do so. It gave rise to respectable methods which they used and created the courses of study where the transportation planning was taught. This is how the now vibrant transportation planning profession came into being.

The moral of the story is this: where there is demand, supply follows. Unlike in health delivery, neither the demand for transportation planning nor the demand for road-safety comes directly from the individual user. It is the government's responsibility (federal, state, or local) to plan for orderly investment in transportation infrastructure and services. Naturally, it is the government's responsibility to deliver appropriate road safety on the infrastructure it plans and builds. If there is to be progress towards rational road-safety delivery, the demand for it must be created by government. This could be done in several ways. For example, one could insist that some decisions must be accompanied by a **"road-safety impact statement."** The need to write such a statement in terms of accident frequency and severity impacts would create an immediate need for knowledge and training. Similarly, one could insist that only professionals trained and certified in the road-safety aspects of their profession may sign plans, designs, and other documents with significant road-safety impact. Another demand-generating direction is the establishment of safety-conscious and knowledge-based procedures in major action centers—the department or ministry responsible for physical planning, the ministry or department of transport, the department or registrar of motor vehicles, the police, the major municipalities, and so on.

Actions of this kind may seem revolutionary against the impoverished landscape of present practice. However, I suspect that the travelling public does not know that the infrastructure on which they get injured with statistical regularity is planned, designed, and operated without knowledge and premeditation of its safety. If they knew then, what now is considered revolutionary, may seem to make common sense and become commonplace. After all, there are no other products known to be similarly injurious to human health that are put into use with the same blissful ignorance of its injury-producing potential as are roads and traffic control on them.

At this point, the main strands of my argument converge. Our road-safety future is determined by the many actors who shape the future transportation system and its use. These actors, by and large, work directly or indirectly for governments or are subject to government regulation. It is therefore manifest that the principal responsibility for the road-safety delivery system is of the government, and, therefore, only action by the government can bring into existence demand for a healthy layer of professionals to be the carriers and suppliers of factual road-safety knowledge.

Training of professionals

Suppose then that the prevailing safety culture has changed, that the government acknowledged its responsibility for our road-safety future, and that demand for trained professionals was created by mandating and funding the use of factual information. Now, there is work to do, and training has to be provided. This raises the question of whether the requisite information exists. Can one write text books and course material? If not, how could one devise adequate training programs? To give an impression about the state of affairs prevailing in transportation engineering, I will describe my experiences in working on the Interactive Highway Safety Design Model (IHSDM) project and in following the first halting steps of the budding *Highway Safety Manual* (HSM).

The goal of the IHSDM project was to create software, enabling designers to predict the safety consequences of design alternatives for rural two-lane roads. Design alternatives may differ in horizontal alignment, vertical alignment, lane and shoulder widths, number of driveways, provision of left-turn lanes at intersections, etc. To assess the safety impact of such design decisions, the project group assembled the relevant published research reports. Some topics were found to have been researched in depth, while very little about others was published. Also, as is usual, the research studies varied in quality and in their conclusions. Once the literature was assembled and reviewed, a group of experts met to hammer out what seemed to be the best conclusions that could be reached at that time. The results of their work are now published (Harwood et al. 2000). There is no doubt that when new research results will be published, much of what has been stated will need to be modified. Nevertheless, there is now an authoritative document that is based on the accumulated empirical research, and that, for a fairly large set of design choices, can guide the designer of two-lane rural roads on the question—What can I expect to be the annual number of crashes on this road if I decide to use design option X? That, heretofore, such a question was not asked by highway designers, and if asked could not be answered, may be puzzling to those who are not familiar with the practice of highway design. In this sense, the IHSDM work is indeed is a quantum leap in present practice. At least in this case, so it turned out, the seven decades of accumulated research provided a sufficient basis for building a rational procedure. It follows that the accumulated knowledge on the safety consequences of design decisions for two-lane rural roads is also sufficient for training.

Experience with the IHSDM emboldened some visionaries in 1999 to think that enough factual knowledge exists to write a modest first edition of a *Highway Safety Manual*—a book containing the best factual information available for transportation engineers. Its first edition is expected in 2008. Work on the HSM, i.e., the process of transforming the vision into a book proved to be tortuous. From my perspective, the obstacles are mainly three.

First, almost a century of research and study resulted in many publications of variable quality and diverse in conclusions. Very few of those studies approach the quality aspired to by evidence-based medicine. Squeezing of what should pass for “factual knowledge” out of these diverse publications is often controversial.

Second, there is a tug-of-war between those who want to include in the HSM statements that are in accord with common beliefs and practice even if not supported by data-based studies and those who hope for the Manual to be a clear break with and a departure from the pragmatic style of road-safety delivery.

Third, no matter how many disclaimers will be written into the preface to the HSM, the factual information in it is bound to raise questions about the appropriateness of present practices that are often based only on common sense and sanctified by a tradition of long use. The inevitable differences between decisions made in accord with the pragmatic style and the rational style bring to the fore concerns about lawsuits, fear of change and its institutional and personal consequences, loss of face or budget or influence, etc. These concerns and tensions are reflected in behind-the-scenes struggles for control, for rights of review, fear of censorship, etc.

Nevertheless, whatever its content will be and however the conflicts will be resolved, the HSM will be published in a few years. This act in itself will be an important step towards rational safety delivery, at least for engineers. It is the act of placing factual information where it belongs —in the hands and minds of those who create a part of our safety future.

The lesson of these experiences is that much factual knowledge already exists and that in some instances, with effort, it can be made into material that can be taught and used. At the same time, it is possible that on several key topics (e.g., transportation planning, subdivision design, traffic calming, and traffic signal coordination) not enough is known to give fact-based guidance. This is not unusual. There are diseases about which medicine knows little and phenomena that scientists do not understand. In medicine, in science, and also in road-safety, research ensures that the domain of what is known continues to expand. In sum, imperfect as the present state of knowledge is, one could put together a respectable curriculum to cater to many training needs.

It is at this point that faith in microeconomics and bootstrapping must kick in. The situation is reminiscent of where transportation planners were in 1954—work needs to be done while tools are few and trained manpower scarce. The faith is that the supply of knowledge and training will grow to meet the demand.

Creation of knowledge

I conceded in "The strap of the boot" that on some issues the knowledge needed for rational road-safety delivery and, in particular, for workforce training does not exist. It is research that generates knowledge, and knowledge is the engine of progress. In road-safety, the generation of knowledge has been slow. True, the problems are not easy to tackle, the data are insufficient, and conducting controlled experiments is seldom possible. Still, given the extent of experience with road building and road use and the large amounts of money already spent on road-safety research, much more knowledge could have been expected. There are two important impediments to knowledge creation in road safety. One is the backwardness and dilettantism that characterizes much of the road safety research community; the other is the Soviet style management of research by those who make decisions about how research should be done and what product is acceptable. Both impediments are discussed at length in Hauer (2005). Only a brief summary will be given here.

Several conditions combine to produce reliable research results. Paramount among those is that the researcher be well trained both in road-safety knowledge and in methods of road-safety research. Gone are the days when teeth were extracted by blacksmiths because they had the tongs and blood was let by barbers because they owned razors. Today, we expect dentists and physicians to be trained and licensed, to acquire experience, and to practice for a long time. Research too is a skill that is acquired by specialized training and by long experience. And yet, for some unfathomable reason, there is a widespread notion that common sense and an undergraduate degree are sufficient to do road-safety research. The upshot is a road-safety literature that is produced in large part by dilettantes and is replete with dubious conclusions.

Dilettantes would not do much harm if their products were kept out of the pages of the professional literature. Unfortunately, the barriers to publication are low. Poor quality research and its unreliable conclusions will find its way into the Transportation Research Record and the ITE Journal because the concept of peer review has been largely corrupted by the same prejudice: namely, that to be a referee of a research paper on road safety, all that is needed is common sense; that training in road safety and in research methods and that experience in road-safety research are not necessary to be a peer.

The problem is compounded by the managers and administrators, by those who decide on research needs, on priorities, on who ends up researching what and in what way, and on the acceptability of the product. Their judgment is good regarding the questions to which their organizations *currently* seeks answers. However, they know little about what is already known, what research can and cannot produce, and about methods that are likely to produce defensible results. This seriously impairs the quality of the decisions they make. Furthermore, the manager-administrators have no understanding of, and no sympathy for, the need of theory to guide productive research or the need for research on methodology to produce more trustworthy results. As a result, research is done about what is of immediate concern and what is pressing; very little research is done about what is fundamental and essential for reaching sound conclusions. And yet, it is this administrative layer who decides what researchers will work on. The compulsion of the administrator-manager to closely control the research process stems not only from the psychology of mistrust and prejudice against the research class; at times it reflects the self-interest of the organizations to which the administrator-manager owes loyalty. What if research showed that a practice or standard now in use is not in the interest of safety or if a program which an organization promoted or in which a politician took active interest is ineffective? Thus, for the administrative mindset, some stones are better left unturned, and some research questions are better not asked. For this, control over aims, process, and product is essential.

A good example is the RFP (Request for Proposals) calling for research to evaluate "Safety Strategies at Signalized Intersections"issued in March 2006 by the National Cooperative Highway Research Program, a body financed by the American Association of State Highway and Transportation Professionals (AASHTO). The text of such RFPs is forged from the views of a "panel" of perhaps a dozen administrator-managers that is drawn almost entirely from state highway departments. The downfall of this RFP and of the panel that inspired it is twofold.

First, even though the panelists are not experts on road safety, they directed potential bidders to propose research on topics they thought important and forbade them to propose research on other topics. Thus, e.g., the bidders were asked not to propose research on the safety effect of signal coordination, even though traffic signals are coordinated in all large urban areas, a large proportion of crashes occur at these intersections, and nobody knows how the main coordination decisions (choice of cycle time and of the green-offset between adjacent intersections) affect crashes. The prevailing practice is to co-ordinate signals so as to minimize delay; the safety consequences of this practice are entirely unknown and, again, unpremeditated. And yet, it is entirely reasonable to expect that crash frequency is related to how often the signal aspect is changed (cycle time) and to how many cars are near the "dilemma zone" when the signal aspect changes, as determined by the green-offset. The panel's failure to recognize the magnitude of the target crashes and their poor knowledge of what is the state of the art in road safety means that a significant opportunity for crash reduction will continue to go unexamined, and the potential safety benefits of signal coordination will be unexploited in all big cities. While such issues of primary importance were explicitly excluded, bidders were asked to consider research on secondary topics such as the effect of providing "public information and education" or of restricting "access to properties using driveway closures." In this manner, scarce research money will likely be spent in ways that are not cost effective.

The second downfall of this RFP reflects the general poverty of NCHRP panels in persons knowledgeable in research methods. The RFP asserts that: "*In this project, data will be collected and before-after safety effectiveness evaluations will be performed at sites where selected safety*

strategies have been implemented." That is, a panel of administrator-managers not only decided what the questions to be researched are but also dictated what research method must be used. Recall that the subject of this RFP was safety at signalized intersections. It is a setting conducive to both experimentation (e.g., changing cycle times or offsets) and natural quasi-experiments (e.g., comparing opposite approaches at the same intersections). But no, apparently the panel knows best!

I do not hope to get much sympathy for my argument from the class of administrator-managers nor from their stable of research consultants; both will resist change. The vibrant safety research community whose absence is lamented is not here to cheer. But this much is certain: material improvement in the product of research in road-safety will come from a well-trained body of researchers working as equal partners within a framework of mutual respect with manager-administrators.

Just as the problem is evident, so the remedy is obvious:

- To do good research, the researcher has to be:
  1. trained in road-safety knowledge,
  2. trained in research methods, and
  3. be in research as a long-term career allowing for the accumulation of research experience.
- Only reports that are properly *peer reviewed* should be published. For this purpose *peer reviewers* are persons who are entirely independent of the organizations that sponsored the research and of individuals performing the research. Furthermore, peer reviewers are persons who are on top of the current safety lore and who are experts in research methods.
- The process of formulating a research program must continue to be influenced by agencies that build roads, operate traffic, or set policies, standards, or warrants. However, the process must not be allowed to be dominated by people ignorant of road safety in general and of research methods in particular. Nor must it be influenced by agencies that have an interest in what is researched, what the conclusions are, and in what stones they like to see unturned. The trained and independent researcher must be an influential partner in the process of formulating research programs, the shaping of RFPs, and the selection of researchers to perform the work.
- To get good research products, the sponsoring agencies must recognize that research is not piecework and cannot be managed as if it were.

Describing the four elements of the remedy is easy. It is less easy to say how the transition from the present research setup to a sounder future can take place. How can researchers be trained in road safety and in road-safety research methods if no university offers such a program? Why should young people enlist in a program to be trained in road safety and research methods (even were one to exist) if there are no progressive career paths in road-safety research? What would one teach in such a program when present knowledge is fragmented, there are no textbooks, and only few qualified teachers? In addition, there is the thorny question of control. How can one induce the agencies that sit on the money (e.g., AASHTO) to give up their tight control over what is done; how can they be made to yield considerable influence over these matters to independent, trained researchers?

Again, the key to creating a sound safety-research infrastructure is demand. If there were steady work, good remuneration, and progressive, secure career paths in road-safety research, talented people would gravitate to the field; if talented people sought training in road-safety research, universities would provide the programs; if graduate programs in road safety were offered, training material would be written. In this case too, demand cannot emanate from the road user. The source of demand for better knowledge can only be created by high-level decision makers in public bodies Were the transportation infrastructure planned, built, and operated by the private sector, the government would be called upon to provide the oversight to ensure that appropriate safety is built into the infrastructure. (Consider, e.g., NHTSA whose role is to make sure that car manufacturers build appropriately safe cars). But, because it is mostly the public sector that plans, builds, and operates the transportation infrastructure and there is no independent overseer, the demand for knowledge-based safety management has no visible patron. The demand must come from within the public sector. However, recognizing the strong organizational self-interest, it is imperative that the demand be guided not by medium-level administrator-managers but by enlightened professional and political leadership. Thus, it is the responsibility of the public sector to create the long-term stable demand for road-safety research, with the promise of progressive employment for a well-trained workforce. If this is not done, future progress will be similar to the past.

The transition towards rational road-safety management is hungry for information produced by competent researchers using good data and methods and working on research programs set up co-operatively by people who know the problems, who know the road-safety field, and who know what research can and cannot do and can distinguish between reliable results and shoddy work. As noted repeatedly, to make progress in this direction will require much political will, considerable resources, and a well thought-out, concerted effort.

In conclusion

There is always more than one course of action, more than one design alternative, more than one decision option. Each action, design, and option has crash-frequency and severity consequences. Is it not obvious that these different safety consequences should be examined before the choice is made? Is it not clear that the future safety of a road should be considered before the ribbon is cut and that the future safety of a new subdivision be examined before it is approved? I think that most road users will be very surprised to learn that this is not done. It borders on the unbelievable that the safety consequences of the actions shaping our safety future are not examined and that many cannot be examined because we do not know enough to predict what they are likely to be. Even more perplexing is the claim that a “cultural change” is needed to convince high-level decision makers of what must be self evident—that we should not stumble into our safety future as blind bats. Just like in the delivery of water, education, or health, road safety too can and should be supplied, delivered, and managed in a rational manner.

A distinction was made between two styles of road-safety delivery. The pragmatic style relies on personal belief and intuition—the rational style on factual knowledge. The history of mankind has been to move away from action guided by intuition and towards actions grounded in knowledge of fact. The delivery of safety is at the beginning of the same road, but the road is blocked by a few big boulders. Foremost is the absence of a trained layer of professionals who can be the carriers of factual road-safety knowledge. This layer does not exist mainly because in the prag-

matic style there is no demand for it. If there is to be progress toward the rational style, the demand has to be created. It can come only from the public sector: those who build the road-safety future and must be responsible for it. Another boulder obstructing progress is the inefficient process of knowledge creation by research. When belief and intuition are deemed sufficient, demand for knowledge is weak. Here too, demand for a vibrant layer of road-safety research professionals free from the Soviet-style interference by administrator-managers has to be created.

How can the public sector be induced to acknowledge the need for rational road-safety delivery and to create the corresponding demand for jobs, training, and knowledge? I can ask the question but am not competent to discuss it, except at the most general and superficial levels. As there is no market in which the individual road user can buy safer roads, it must be done through pressure and representation. In this, the AAA has an obvious role. In some respects, the situation is similar to that in the 1960s when Ralph Nader published *Unsafe at any Speed*. This booklet, more than anything else, caused safety to be more carefully considered in the manufacture of motor vehicles. In the "Preface," Nader writes—"A transportation specialist, Wilfred Owen, wrote in 1946, 'There is little question that the public will not tolerate for long an annual traffic toll of forty to fifty thousand fatalities.' Time has shown Owen to be wrong." Owen is still wrong; in the 2000–2004 period there were nearly 42,000–43,000 fatalities every year. Perhaps, if the travelling public knew the extent of ignorance about safety with which roads are created and operated, the requisite pressure would materialize. Unfortunately, Nader's task was easier in one important respect: his target was the private industry which we do not trust to be a sufficiently diligent guardian of public safety. This is why NHTSA was created and made into an overseer. Our future safety is created largely by the public sector, which is traditionally viewed to be on the side of the angels. Quod custodiat ipsos custodies?

References

American Association of State Highway and Transportation Officials (AASHTO). 1998. *AASHTO Strategic Highway Safety Plan*. Washington, DC.

———. 2001. *A policy on geometric design of highways and streets*. Washington, DC.

Federal Highway Administration (FHWA). 2000. *MUTCD 2000, Manual on uniform traffic control devices*. Washington, DC.

Harwood, Council, Hauer, Hughes, and Vogt. 2000. *Prediction of the expected safety performance of rural two-lane highways*. US DOT, Federal Highway Administration, FHWA-RD-99-207.

Harwood, D. 2002. Draft Work Plan, *Comprehensive Highway Safety Improvement Model (CHSIM)*, Midwest Research Institute, Kansas City.

Hauer, E. 2000a. *Safety in geometric design standards I: Three anecdotes*. Proceedings of the 2nd International Symposium of Highway Geometric Design, R. Krammes and W. Brillon, eds. Forshungsgeselschaft für Strassen und Verkehrsvesen e.V., Köln, 11–23. (Downloadble from: roadsafetyresearch.com).

———. 2000b. *Safety in geometric design standards II: Rift, roots and reform*. Proceedings of the 2nd International Symposium of Highway Geometric Design, R. Krammes and W. Brillon, eds. Forshungsgeselschaft für Strassen und Verkehrsvesen e.V., Köln, 24–35. (Downloadable from: roadsafetyresearch.com).

———. 2005. The Road Ahead, *Journal of Transportation Engineering,* ASCE 131 (5): 333–9 (Best Paper, 2005).

NCHRP. 2006 *Core competencies for highway safety professionals, research results digest 302*, based on Prevalence of traffic safety content in graduate engineering and public health programs: Full Report. Gross, F. and P. Jovanis, TRB, June 2005.

Transportation Association of Canada (TAC). 1999.*Geometric design guide for Canadian roads*, Transportation Association of Canada, Ottawa.

Weiner, E., 1997. *Urban transportation planning in the United States: An historical overview*: Fifth Edition. Retrieved on Jan 8, 2006 from http://tmip.fhwa.dot.gov/clearinghouse/ docs/utp/.

Wikipedia. 2006. *Evidence-based medicine*. Retrieved on July 28, 2006 from: http://en.wikipedia.org/wiki/Evidence-based medicine.

Biographical statement

Dr. Ezra Hauer is a Professor Emeritus in the Department of Civil Engineering at the University of Toronto where he has earned international renown as an innovator in engineering principles. Dr. Hauer has been active in road safety research and consulting since 1970. He completed his bachelor's and master's degrees in Israel, and later received his doctorate from the University of California, Berkeley.

Dr. Hauer has gained an international reputation for his scientific rigor and practical understanding in the study of the relationships between roadway design and safety. In addition to developing new statistical methods and theories, he has excelled in translating statistical theory into techniques useful for practicing engineers and researchers alike. His book, *Observational Before-After Studies in Road Safety* (Pergamon 1997), provides invaluable guidance to state and federal transportation agencies as well as to the research community. Recent and ongoing projects include work on safety improvements at signalized intersections, safety effects of resurfacing roads, safety analysis of roadway geometry and contributions to the Canadian Geometric Design Guide.

Dr. Hauer has published numerous articles, papers, and reports, and has received many honors. Most notably, he received the Roy W. Crum Award, the highest honor bestowed by the Transportation Research Board, for his outstanding contributions to developing and using statistical and experimental methods in transportation design and safety. He was a director on the Transportation Safety Council of the Institute of Transportation Engineers (ITE) from 1993 to 1995, and he received the ITE Transportation Safety Award in 1993. He has served as vice president and president of the Canadian Association of Road Safety Professionals, and chaired the International Committee of Symposia on Traffic and Transportation Theory.

Development of an implementation infrastructure to support a traffic safety culture

Barbara Thomas Harder

B. T. Harder, Inc.

Overview

> *The incentive to **do** research is greater than the incentive to **report** research—especially in the language and detail such findings can be implemented* (Watkins 1974).

There are successful strategies to increase the potential of producing benefits from research activities. These strategies streamline the adoption of new methods, processes, or technologies, create a more effective return on investment of research funds, and enable a more rapid application of worthy improvements to the system. However, implementation of research results and innovations do not happen automatically. Purposeful effort must be taken to facilitate the implementation of research results to realize the anticipated benefits of the research activities.

Because there are successful strategies that will increase the potential to affect change in the current culture for traffic safety, the primary purposes of this paper are 1) to focus attention on the critical role of implementation of beneficial research results, 2) to facilitate the process of implementation by suggesting the creation of a traffic safety research implementation infrastructure, and 3) to firmly place the activities of implementation in the position of being entirely merged with the work of research. The overarching outcome is to assure that productive research results are integrated into operations as a viable and even preferred choice to support decision making and for accomplishing specific tasks.

Taken as a whole, the variety of successful implementation strategies forms an implementation infrastructure. The infrastructure has five basic elements, *Technology* (the research results to be implemented), *People*, *Marketing and Communications*, and *Implementation Tools*, plus *Levers* that increase the effectiveness of the other four elements. This infrastructure presents a systematic approach to accomplishing implementation of research results. This systematic approach—applying the strategies of an implementation infrastructure—can and should be incorporated into the research activities being performed to enhance the traffic safety culture. If the members of the traffic safety community, particularly the sponsors and those vested in the results of research, use strategies for successful implementation, these actions will corporately build a traffic safety implementation infrastructure. The implementation infrastructure will more effectively enable the institutionalization of positive change and adoption new behaviors, products, methods, and practices within the traffic safety community and among transportation users of this nation.

Introduction

Purpose and scope

One of the most critical issues facing research and education that contributes to a traffic safety culture is whether the results of the research and innovative practices are used. Creating or enhancing such a culture for the United States implies the intent to implement the best practices and the most successful innovations identified nationally and internationally. To bring about change, making use of successful innovations is necessary. However a significant issue accompanying use of research results or innovations is technology and knowledge transfer—the implementation processes that sustain and institutionalize positive change.

While basic research to develop new knowledge in safety topics is highly desirable, the AAA Foundation's goal of fostering and improving a culture of traffic safety points toward applied elements of a broad research program. An objective of the traffic safety culture, therefore, must be application of research results. Such implementation of new methods, processes, and products leads to changes in organizational operations and user behavior—the opportunity to influence the way safety is addressed and incorporated into the nation's transportation choices. Past research has shown the need for assistance in implementing research results and innovative practices, especially in the public sector. (Bikson et al. 1996; Deen and Harder 1999; Harder and Benke 2006). Moreover change in the public sector generally is not easy, is often accompanied by increased risk to multiple parties, and requires substantially more resources and effort than expected.

There are successful strategies to increase the potential of benefits resulting from research activities. (Harder and Benke 2006). These strategies streamline the adoption of new methods, processes, or technologies, create a more effective return on investment of research funds, and enable a more rapid application of worthy improvements. However, implementation of research results and innovations does not happen automatically. Purposeful effort must be taken to facilitate the implementation of research results to realize the anticipated benefits of the research efforts.

Because there are successful strategies that will increase the potential to affect change in the current culture for traffic safety, the primary purposes of this paper are 1) to focus attention on the critical role of implementation of beneficial research results, 2) to facilitate the process of implementation by suggesting the creation of a traffic safety research implementation infrastructure, and 3) to firmly place the activities of implementation in the position of being entirely merged with the work of research. The overarching outcome is to assure that productive research results are integrated into operations as a viable and even preferred choice to support decision making and for accomplishing specific tasks.

The strategies and concepts for implementation of research results and innovations to foster and improve a traffic safety culture are applicable on two levels. Implementation issues must be addressed at a program level as well as a project level. Program-level implementation strategies deal with building trust and credibility through identifying relevant research goals and projects, and communicating the benefits of the research once it is deployed. Project-level implementation strategies center on the methods and tools used to put a research result into standard practice.

Many of the strategies are common to both levels and addressing both the program and project levels is essential for fostering an increased awareness and application of traffic safety research results.

Taken together, the elements and activities that cause a research result or innovation to be applied can be viewed as a basic framework for implementation, an implementation infrastructure. Such an infrastructure can and should be built into traffic safety research activities. An implementation infrastructure will assist in assuring that successful research results are put into practice.

The best time to consider the use of research results is at the beginning of the overall research effort. The allocation of resources for implementation needs to be considered as part of the whole research process from problem identification through creating a new standard of practice based on a broadly implemented technology or innovation.

Although a number of public-sector transportation research programs are very successful at implementing the results of their research, other programs continue to struggle in this area. Hurdles abound such as addressing research results implementation in a fragmented manner rather than using a systems perspective, failure to consider research as a strategic asset that contributes to national or organizational goals, the misunderstanding of needed resources for implementation activities, and the continued difficulty in determining quantitative benefits of research and implementation are challenges that continue to require attention. A more effective process for implementation of research results across the whole of the traffic safety community, however, will assist in solving a number of these challenges.

Literature and data sources

The primary sources of information for this paper focus on public sector transportation research conducted through state departments of transportation. (DOTs). These sources are the National Cooperative Highway Research Program (NCHRP) synthesis reports on research management topics: *Synthesis 280, Seven Keys to Building a Robust Research Program* (Deen and Harder 1999), *Synthesis 312, Facilitating Partnerships in Transportation Research* (Harder 2003), and *Synthesis 355, Technology Transfer: Successes, Challenges, and Needs* (Harder and Benke 2006). These reports are state-of-practice reports that document a snapshot in time, highlight successful practices, and provide practical examples of methods, procedures, or tools. Because NCHRP is an American Association of State Highway and Transportation Officials (AASHTO) effort, these syntheses reflect a high level of contribution from state DOTs. Additionally, each of these synthesis reports also includes state-of-practice information from the private sector and academic institutions.

A second and related source of information for this paper is a number of example state DOT research programs that have been performing strategically valuable research over many years. These programs have developed, whether purposefully or not, an infrastructure for their implementation activities. Programs like those operating at the Virginia Transportation Research Council, the Joint Transportation Research Program (Indiana Department of Transportation, Purdue University, FHWA), or past programs like the initial Strategic Highway Research Program, teach valuable lessons for applying results to practice. Furthermore, concepts are incorporated in this paper from work currently in progress with the Pennsylvania Department of Transportation's Research and Innovation Implementation Program.

In addition, the classic publication, *Diffusion of Innovations*, by Everett M. Rogers presents important treatment of the manner in which innovations are put into practice. A further source of information is the Research Peer Exchange meetings conducted by the state DOTs' research units to enhance their research management practices.

Definitions

The terminology for implementation of research results often has a variety of definitions, many of which may be acceptable. However, for this paper the definitions used in the recently published NCHRP *Synthesis 355, Technology Transfer: Successes, Challenges and Needs* are used.

> *Adoption or Application to Practice*: Making a technology or innovation an organization's standard operating procedure or causing the technology or innovation to be used as the generally accepted means for accomplishing a specific task. Such action is an outcome of implementation of research results or technology transfer activities.
>
> *Deployment*: The systematic process of distributing an innovation for use. This term implies a relatively broad use, rather than pilot, demonstration, or incidental use of the innovation. A technology can be considered deployed when it is used multiple times within an organizational or group context, such as use resulting from a newly written specification.
>
> *Knowledge Transfer*: The diverse activities causing the flow of knowledge from one person, group, or organization to another. Such knowledge transfer can be a systematic process to identify, capture, and share tacit knowledge to enable it to become explicit knowledge.
>
> *Implementation of Research Results*: Used in highway transportation and particularly by the research community to describe the various activities required to put an outcome of a research project into widespread use. Oftentimes, this term is used synonymously with technology transfer by those in research. The activities can span the entire duration of the research project and extend until the research result is adopted, for example, as part of a standard operating procedure. Implementation activities may be pilots or demonstrations, training, technical assistance, provision of needed resources, or any activity that fosters use of the research result.
>
> *Innovation*: A procedure, product, or method that is new to the adopting organization. The item may be a result of research or may be a new application of an existing improvement that has been used in another context or other organization.
>
> *Technology*: A term used very broadly to include practices, products, processes, techniques, and tools.

> *Technology Transfer*: The activities leading to the adoption of a *new-to-the-user* product or procedure by any user or group of users. New-to-the-user means any improvement over existing technologies or processes and not only a recent invention or research result. Technology transfer includes research results implementation and product or process deployment. Activities leading to the adoption of innovations can be knowledge transfer, training and education, demonstrations and showcases, communications and marketing efforts, technical assistance, and more (Wallace et al. 1998; Schmidt et al. 1985). In addition, technology transfer in this transportation context also includes the complex process of change, a comprehensive achievement dealing with cultural as well as technical issues

Needs and gaps

> *From the first… research is the process of reducing an idea to practice… Research efforts cannot long survive without some promise of implementation of their findings.* (Watkins 1974)

For decades, implementation of research results has been an issue demanding attention from organized transportation research programs in the U.S. The primary concern was described in one of the early National Cooperative Highway Research Program Synthesis Reports, No. 23, *Getting Research Findings Into Practice* as "The incentive to *do* research is greater than the incentive to *report* research—especially in the language and detail such findings can be implemented" (Watkins 1974). Additionally, in 1967 getting results applied was a concern for an AASHTO Special Committee on Utilization of Research (known as the Stevens Committee). The committee, "noted that there was an undesirable and unnecessary time lag between the completion of research and the utilization of that research" (Hodgkins 1989). An outcome of the committee's effort was seen at that time in FHWA's formation of an Implementation Division that specifically addressed accelerating the utilization of research results.

More recently, implementation of research findings has been the subject of various NCHRP efforts as well as with programs such as AASHTO's lead states' activities, and its Technology Implementation Group, as a focus of FHWA/state DOTs research organizations' peer exchange meetings, and the FHWA's promotion of its Priority Market-ready Technologies and Innovations. Moreover, as an example of the awareness of the need for assistance in application of innovations, there is implementation guidance for applying strategies of the Strategic Highway Safety Plan.

These types of implementation-related activities show a recognized need for special effort to apply innovations and new technologies to practice. Yet programs and research projects still struggle to be successful in making the leap from research result to realizing the benefits of the research. Public-sector programs have a difficult time because often there is no structured approach to implementation of research results, no manner by which management can formally support research efforts, and little understanding of the challenges associated with their implementation.

Adding to the struggle, research programs have in implementing their results is a considerable degree of risk aversion in the public sector. Public servants are understandably reticent to move from a currently successful treatment to anything different. Lives are at stake, taxpayers dollars are used, often in large amounts, and major consequences can occur due to failure. Furthermore,

for public applications of the research results, the effort to adopt a new method, process, or product can be overly burdensome. The effort to implement a new process or innovation may require anything from an act of the legislature to writing a new specification or addressing intellectual property rights—all of which must be accomplished within a bureaucracy that is not necessarily attuned to research operations.

Compounding the concerns for exposure to risk is a need for the research community to better communicate that research activities and their results are a strategic asset to the sponsoring agency and to the practicing community at large. Research programs are one element in an executive's portfolio for productive, effective agency management. Results of research save dollars, enable greater efficiency, reduce fatalities, and produce a host of other benefits. Yet, the message of "research as a valuable strategic asset" is often neglected or not expressed in terms usable by executives.

The needs and gaps related to research results implementation can be addressed to some degree by conducting implementation of the research results with the same commitment and focus as that devoted to the actual research effort. NCHRP *Synthesis 355* notes that DOT research programs spent 6.5 percent of all research and research-related funds on technology transfer and implementation activities. Experience shows that this is not a sufficient level of expenditure. Furthermore, agencies or programs having an identified coordinating role for implementation had a greater openness to incorporating innovations to the agency and more readily recognized the positive influence of senior management in the process of implementation. Other findings from this study concluded that in 2003/2004, nearly fifty percent of state DOT research program survey respondents had five years or less experience in technology transfer or implementation—and those with 15 years or greater tended to have a more robust research implementation effort.

While several of the syntheses discussed in this introduction present good things to do to increase the effectiveness of research results implementation, a systematic approach is lacking. Many programs make an effort to apply successful strategies for implementation of research results. However, most programs whether they are state DOT programs or industry or research community-driven initiatives, fail to address implementation activities as a priority program element. Many research programs treat implementation activities in ad hoc manner. There is little recognition of the interdependency of the various implementation strategies and the need for treating implementation as a complete process. The greatest need or gap is to address implementation through an organized systematic approach that incorporates all the resources required to get the job done—to change practice and apply improvements.

Creating change

> *…agencies must use research findings—primarily to change practice.* (Watkins 1974)

Implementation of innovations resulting from research is an important means of addressing and creating change in an organization and throughout standard practice. If the research program is built upon the concept that research is a strategic asset, the results of which will produce strategic value, research can be a powerful tool to improve and enhance management and operational effectiveness. Simply put, the change brought about by successfully implementing the results of research is improvement in the state of practice.

The strategies used to foster implementation directly deal with creating a receptive environment to allow change to happen. Researchers, research managers, and users alike will perform more efficiently if implementation strategies are used. It is critical to note that following a systematic approach to implementation of research results presents the likelihood of more consistent and sustainable change.

Various research programs are successful at implementing innovations generated by the research or in use by others. In general, these programs are well established and have, through time, created a well-run system for applying innovations to practice. A vision for the traffic safety culture is to learn from these programs, not requiring the years taken to adopt these strategies incrementally, but using the existing successful implementation strategies as a coordinated process.

Research leading to an enhanced culture of traffic safety needs a well-prepared implementation process that is responsive to creating positive change. Sponsors of traffic safety research can incorporate implementation strategies, building an implementation infrastructure for traffic safety improvements.

Creating an implementation infrastructure

Goal and vision

The most important goal of any research activity is the result of the research effort and how it will be used. With basic or fundamental research, new knowledge for use in subsequent research activities is the primary goal. With applied research, the results are put into practice to improve current practice. For the most part, research that is to further and enhance a traffic safety culture will tend to be applied research—directly seeking to change behavior and create improvements to practice.

The vision for accomplishing traffic safety research involves providing answers to many difficult and some long-standing problems, and then having the answers positively affect practice—that is, to enhance the traffic safety culture. To fulfill such a vision, implementation of the research results must be a vital part of the research activities. In fact, without incorporating a purposeful implementation effort within the research initiative, the vision will very difficult to accomplish.

Changing roles

Roles within the public-sector applied-research community are changing. The standard role of researcher had been to perform the research, write the report of findings, and move on to tackle the next problem. Furthermore, research program managers and research sponsors were concerned with getting the research results delivered within the appropriate administrative structure. The users coped with change in the best manner they could. Since the early 1990s, researchers, program managers, and users alike have been experiencing a growing awareness of the importance of their respective roles in fostering implementation of research results. Researchers, for example, are being drawn into the implementation process through being

prompted to create implementation plans, by having greater interaction with the ultimate users during the course of the research, and by being asked to provide more user-ready innovations. Research program managers and owners are being required to fill the role of partnership manager, entrepreneur, and transfer agent. Users are now more frequently being consulted regarding how best to deal with change, are developing into champions, and are being more effectively prepared to handle new products, processes, or methods.

The role of research is beginning to change as well. In the past, research efforts were regarded as a project-defined, problem-solving activity—limited by the technical aspects of the problem. Today, of course, research must still solve problems, but it is now being recognized as a strategic asset that advances the agency's strategic agenda, contributes to agency mission and goals, and brings value to the organization.

The importance of these changing roles for the traffic safety culture is: 1) to recognize the contribution of the various participants in the process of implementation and to effectively use them to maximize the benefits of the research efforts and 2) to encourage the perspective within the transportation community that implemented research results are valuable strategic assets for accomplishing programmatic or organizational goals.

Infrastructure elements

There are a number of excellent strategies being used to foster the implementation of research results. Each strategy, when applied, can produce beneficial results. Certainly, public-sector transportation research programs today have learned some solid implementation lessons: that champions of an innovation are critical to sustain promotion of the research result, that senior management support is often the extra incentive for operational staff to give the innovation a try, or that planning for implementation significantly increases the potential for getting an innovation applied. However, when strategies are used in combination with others, greater benefits are the likely result, and more can be done by developing a more rational approach than just picking and choosing whatever strategy seems to work. Implementation needs a framework, an infrastructure that allows the successful implementation strategies to be addressed in a systematic, organized manner. When the whole traffic safety community applies successful implementation strategies, an implementation infrastructure will emerge.

An implementation infrastructure for applied research is built with five major elements: technology, people, marketing and communications, tools, and levers that enhance implementation effectiveness. Each of these five elements and the strategies they represent are discussed below.

Technology

The initial element of the implementation infrastructure is the "technology"—the research result or innovation that will be put into practice. (Technology is being used in a broad context, a new or improved product, process, or method.) Three strategies are discussed in this section: the push of the technology, pilots and demonstrations, and benefits of research results—meeting users' needs.

The technology "push"

Often results of research or innovations are championed by organizations and individuals having excellent technical credibility. Considering these members of the transportation community are trusted and reliable, they are a source of potentially very successful innovations for other users. The technology is pushed out from these innovators through effective technology transfer or deployment activities. Examples of such activities are AASHTO's Technology Implementation Group, FHWA's promotion of its Priority Market-ready Technologies and Innovations, and research results from well-respected organizations in the transportation community. The value of these types of innovations is that they have been vetted by trusted bodies. The consensus and widespread backing that caused the innovation to be endorsed by such organizations provides a jumpstart for the user. Generally, such innovations entail lower risk to the user because champions of the research result and early adopters have already implemented the research result. The user may have to customize the innovation to its operating environment, yet often the championing organizations will provide assistance in accomplishing that task. Fostering a traffic safety culture can use this type of strategy. If credible organizations supported specific safety innovations for implementation, prospective users will have greater trust in the innovation and will be more predisposed to apply it in their own contexts.

Demonstrations and pilots

Providing a hands-on demonstration to show research results is one of the most attractive means to get users to consider adopting an innovation. Seeing the innovation in operation or being applied is proof that the innovation works. Moreover, demonstrations provide an excellent opportunity for the potential users to determine "up close and personal" the applicability of the innovation to their own needs. Demonstrations are best conducted in the type of setting that most accurately represents the user application settings. In addition, technically competent individuals must be available to answer the potential user's questions. The strategy of conducting demonstrations reassures the potential user that the innovation "will also work for me." Results from traffic safety research activities can employ demonstrations to educate and involve potential users. In particular, demonstrations to opinion leaders of ready-to-apply research results are especially effective. It is this segment of the user population who will motivate others to also adopt a new practice. Demonstrations or "Showcases" have been very effective for the Florida DOT Local Technical Assistance Program, among others.

Pilots—an initial use of the research result in a user setting to exhibit the performance or effectiveness of the innovation; a pilot can be conducted toward the end of the research activity to supply empirical proof of the innovation's effectiveness—often a proof of concept. Incorporating pilots into the plans for research to affect change in the traffic safety culture will assist in producing ready-to-implement innovations. In fact, both demonstrations and pilot uses of a research result will enhance implementation efforts.

Benefits of the research result—meeting user needs

For applied research, the benefits of the research result must address the user's needs. If the research result provides a solution to a well-known problem or presents a recognized safer or more effective means of accomplishing a task, this assists implementation. Addressing needs allows champions to support the research result, enables senior managers to endorse the change, and provides a solid message for communications regarding the effort. However, because a need

is met does not reduce the necessity for a focus on implementation of the research results. Implementation hurdles still abound even if one "builds a better mousetrap."

The research performed to foster the traffic safety culture likewise must address the users' needs. Finding solutions to the users' needs establishes vision and purpose for the research, assisting researchers, research managers, and users to overcome even most difficult of barriers. In addition, the credibility of the research initiative will be served if outcomes of the research effort are seen to directly affect current practice.

People

People are a critically important resource for enabling implementation. The three strategies discussed in this section are champions, placing qualified people in lead roles for implementation and early involvement of the users.

Champions

Champions are the people who believe in the benefits and applicability of the innovation and are committed to getting others to know about and apply the improvement. Champions are technically qualified, credible members of the user community who have experience with the innovation either as a very early adopter of the innovation or through having been involved with the research effort. Every new product, process, or method needs champions to keep the "new way of doing things" in front of the user community. Champions often head up implementation efforts. In fact, the Virginia Transportation Research Council will not forward a research proposal unless it has a champion. For research projects addressing traffic safety culture issues, champions should be identified for the various efforts so that strong, credible voices will support the application of the innovation.

Qualified people in lead roles

Coupled with the presence of a champion is the necessity to have very qualified people involved with implementation efforts. In the public sector, often the job of fostering implementation is given to junior personnel and assigned as a collateral duty. The activities for furthering the use of a research result, then, can get bogged down because the person leading the implementation has no voice in the organization, may not have the technical qualifications to be a leader for the organization in adopting something new, and then has other duties that most likely are given priority over the job of implementation. To forward research that will create change in traffic safety, there must be qualified lead people, those respected by peers, as the agents for adopting innovations into an organization. The expert task group concept used by the SHRP program is an example of using such qualified people.

Early involvement of the users

One of the most basic tenets of implementation is to involve users early in the research process. For applied research results to be well accepted by the users, the users must have input to the conduct of research. User-oversight groups, user websites for the conduct of the research, and any user contact that will help shape the results to be more readily applicable at the end of the research effort are beneficial for implementation. Often user involvement in the research helps

the researcher to have a result that is known among the user community prior to the completion of the research project. Once the innovation coming out of the research is available, an influential segment of the user community is ready to adopt it.

Marketing and communications

Implementation of anything new requires marketing and communicating the message of the research's benefits through established channels. These strategies are discussed below.

Message

Organizations that are successful in implementing their research results and their programs "market boldly," one of the seven keys to building a robust research program (Deen and Harder 1999). Unfortunately, researchers and those managing research, for the most part, do not have communications expertise as their primary background. Developing a message of improvement, the new standard operating procedure, or a new manner of conducting the assigned task is not a strength of the research community. The implementation effort needs to get the message of innovation to senior management, opinion leaders and early adopters, and the general user community. If the talent to get the message to the right people is not available, programs that are successful at implementing research results get the talent and use it wisely. Fostering or improving the traffic safety culture has a serious task of creating excellent communications about the innovations and results of research. Communicating a critical message will not just happen. Talent to assure the message is crafted well and disseminated appropriately is necessary.

Networks/established channels

Building a network or channel for communications is an essential part of the implementation infrastructure. The message of innovation—improvement, cost savings, or safety will be carried more quickly and accurately if an established network exists. The network includes 1) the researchers, and the organizations sponsoring the research and overseeing implementation, 2) executive and other management that will influence the use of the research results, and 3) the user community. The Pennsylvania DOT is currently establishing an implementation infrastructure which includes creating a network throughout the organization to foster the identification of innovations and to implement research results that are ready to be applied. Research addressing a traffic safety culture, likewise, will need an effective network of implementation agents ready to encourage and foster application of the results of research.

Implementation tools

Four tools are important to the process of implementation and are included in the implementation infrastructure: an implementation plan, a means to identify successful innovations, a web portal or electronic home base for implementation activities, and implementation packages containing whatever is needed to further the implementation.

Implementation plan

Just like the research plan, an implementation plan is important for achieving success. The implementation plan identifies the anticipated resources required for application of the research results and describes the activities that will most likely further implementation. The implementation plan is prepared early during the conduct of research and may even be part of a researcher's proposal to perform the research. If necessary, the plan assists the researcher to point toward implementation of the result rather than only to achieve the answer to the problem being researched. Moreover, the plan presents the opportunity to incorporate users into the conduct of research, where appropriate, so that the research results will be more applicable.

Identifying successful innovations

A number of organizations that focus on implementation have a tool to assist the research program management to determine whether a result of research is ready to be implemented. These tools are an initial screening device that provide sufficient information to make a "go," "not yet," or "no go" decision regarding the implementation. Minnesota and Virginia DOTs have used a series of questions to determine readiness for implementation. The Pennsylvania DOT Research and Innovation Implementation Program currently uses a "Checklist for Winning Innovations." This checklist asks questions regarding what is in place, such as resources, champions, and implementation tools—and what is needed, including hurdles to overcome, benefits identification, additional resources, and other support. A "ready to implement" decision can be made upon review of the information supplied on the checklist. Because research results often require more work prior to implementation, tools like this are very valuable. They save time and effort and help advance the research results that are truly ready for application. Tools or screening such as this will be helpful for research results that forward a traffic safety culture.

Web portal

An electronic home base for research activities is very desirable. A web portal can provide a host of purposes that enhance implementation efforts. Researchers, research program managers, and users alike will find web access to program elements enhances communications, permits administrative tracking, and enhances dissemination of available implementation products. An important function also is to provide space for sharing of best practices. In addition, when implementing research results for the general public, such web access is indispensable for promoting those best practices.

Implementation packages

One of the most important tools that can be developed for implementation is a package of whatever is necessary to assist users to adopt a research result. These packages can contain training materials, information bulletins/specification sheets, news articles, contact information for technical champions and current users, demonstrations information, or whatever is required to ease the user's transition to the new way of doing things. The critical aspect of these packages is that they are available when a user requires them. The innovations developed to enhance the culture for traffic safety will benefit by having implementation aides packaged for users to ease transitions to use of new practices.

Levers

There are four strategies that work like levers when applied to the implementation infrastructure. These strategies multiply the effect of the implementation activities. Partnerships and alliances, committed funding, a coordination function, and senior management support all increase the effect of the other strategies in the infrastructure.

Partnerships and alliances

Partnerships and alliances benefit the conduct of research for state DOTs by leveraging most particularly, technical expertise and funding (Harder 2003). In general, partnerships for research are organized because there is mutual advantage for all partners. Together, the partners can achieve results that each partner individually could not do, or do as effectively. Partners make available a broader base from which to promote the benefits of the result of the research effort. In the same way, collaborative research provides a broader distribution of the risk associated with promoting the results of the research effort. One drawback of creating a partnership for research activities is the loss of some control over the research as the direction of the research becomes collaborative. Yet this is a small price to pay considering the other valuable advantages especially for implementation of the research results. Research partnerships for work done to encourage and promote the traffic safety culture will multiply the resources contributed by each partner.

Committed funding

In the past, implementation of research results has not been considered a specific activity to be funded. Implementation efforts were recognized as needed, but few funds were committed to the job and mostly operational areas were expected to pay the costs of adopting something new. Appropriately, research programs have carefully guarded the funds designated for research to be used for research. Today, however, transportation research managers in the public sector are realizing that research funding must be augmented with implementation funding. Unlike the private sector, the public sector has no profit incentive that often provides funding to get a product to market. Yet state DOTs, like Minnesota's DOT, that do provide committed funding for implementation, are noted innovators. Funding implementation is a powerful lever for increasing the effect of the implementation activities. Moreover, this funding must be reserved for implementation only. Funding assists in marketing, preparing implementation tools, travel for champions, and a host of other tasks that allow an innovation to be applied to practice. Mistakenly research initiatives or program managers may not include a budget for implementation during the research program or project planning.

Currently the state DOTs are spending, on average, 6.5 percent of their available funds for research and related activities for implementation (Harder and Benke 2006, 27). More consistent implementation successes tend to be seen in programs with long-standing implementation experience, and these programs are committing greater funds for implementation activities. Research results promoting a traffic safety culture will also need committed funding for implementation and, likely, in amounts greater than the average that the states are currently committing for their implementation of research results.

Coordinating function

An effective lever for implementation is a coordinating function for implementation activities. This is an individual or an organization that assures the implementation infrastructure is working and that implementation strategies are being used. This function also serves to enlist the people, tools, and other resources necessary to allow an implementation to happen. Generally, the cost (in time and dollars) of such a role is far outweighed by the positive results achieved. Organizations involved in traffic safety research can serve as this type of coordinating function.

Senior management support

Change can happen without senior management support, but it is easier if the top people in a field or an organization endorse and actively support the change. The degree of management support a research result garners is also important. The support must be fully and genuinely given. Strong management support usually guarantees that the research results will receive due consideration by the users. Executive support within an industry does much the same as that of senior management within an organization. Endorsement of a research result by recognized leaders is a factor that influences people to try something new. There are few more effective levers than senior, influential people championing an innovation. In fact, this lever often positively affects many of the other implementation strategies, such as commitment of resources including technical expertise and funding. Advancing the traffic safety culture will entail planning to enlist the executive level support that the changes in the culture will require.

Infrastructure elements summary

In summary, the strategies discussed herein form an implementation infrastructure. The primary elements of the infrastructure are Technology, People, Marketing and Communications, Tools and the Levers that multiply the effectiveness of the individual strategies contained in the other four elements. Figure 1 shows the effectiveness increase of the levers on the other elements of the implementation infrastructure.

Every research sponsor can be a positive factor in promoting implementation of research results. Sponsors can review the infrastructure strategies and determine the extent to which they can provide the necessary resources and procedures that will promote implementation. Federal agencies sponsoring traffic safety research such as the Federal Highway Administration or the National Highway Traffic Safety Administration are in excellent positions to enhance their present efforts or to incorporate the implementation strategies discussed in this paper into their programs. These agencies can contribute substantially by setting the example for requiring implementation strategies to be accomplished in association with the research they sponsor or results they promote.

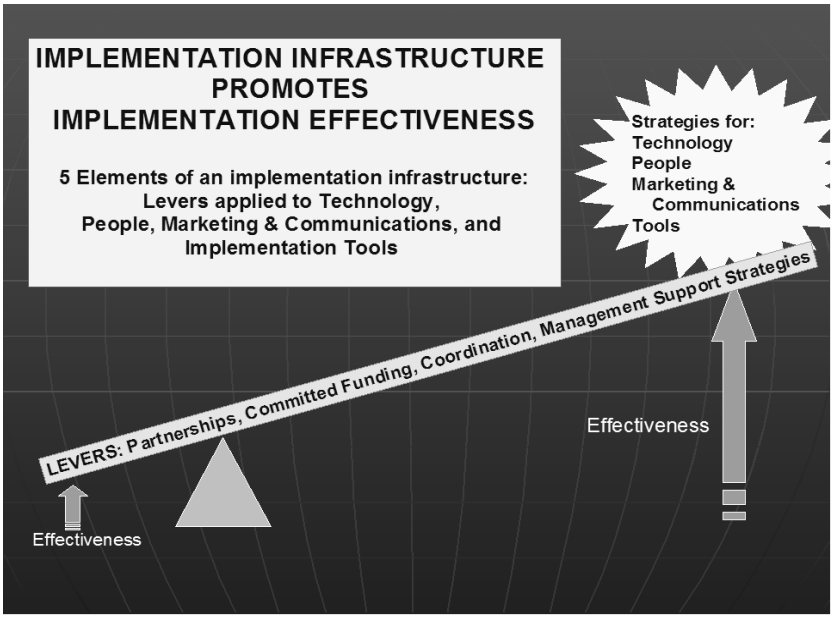


Figure 1. Implementation infrastructure promotes implementation effectiveness.

Organizations such as the AAA Foundation for Traffic Safety can provide valuable leadership by encouraging systematic implementation practices. For example, the Foundation can perform the following functions.

1. For the technology element of implementation:
    - Champion credible innovations and technologies.
    - Promote and collaborate with others for the sponsorship of demonstrations of viable traffic safety research results and innovations.
    - Include pilots of research results in its research activities and encourage others to do so as well.
    - Be a vigilant voice to assure research activities are addressing genuine user needs.
2. For the people element of implementation:
    - Encourage champions to promote viable traffic safety research results and provide a forum or structure for champions to communicate with other researchers, others performing implementation, and users.
    - Promote organizations to put forth their best talent to do the job of implementation of the results of traffic safety research.
    - Through the research it sponsors, as well as through research partnerships and collaborations, provide opportunities for user involvement in the conduct of the research.

3. For the marketing and communications element of implementation:
    - Provide a voice for the message of improvement and change affecting the traffic safety culture that is enhanced by using systematic implementation strategies.
    - Develop, promote, and use networks and channels for communicating traffic safety improvements that will enhance the culture of safety in the US.
4. For creating implementation tools for implementation:
    - Develop in conjunction with researchers, implementation plans for the Foundation's research as well as for research activities in which it collaborates.
    - Promote use of screening tools to determine the implementation readiness of innovations and research results.
    - Encourage or participate in enhancing or creating appropriate web-based resources for the traffic-safety community to share best practices.
    - Participate in developing implementation packages for research results of traffic safety research activities to enable users to effectively change practice.
5. Though use of the implementation levers:
    - Participate and encourage partnerships and alliances to leverage the expertise and funding, among other items, that are required by traffic safety research activities.
    - Be a coordinating function among traffic safety research sponsors to promote synergy in research and to help avoid duplication of effort.
    - Attract and encourage senior management within the transportation community to champion traffic-safety improvements and to supply resources to accomplish them.

If organizations, as mentioned above, and others in the traffic safety community will adopt and invest in the various applicable implementation strategies together as a community, an implementation infrastructure will emerge. A positive result will be achieved by using some of the individual strategies, but a purposeful approach will produce an infrastructure of reliable methods to assure the best environment for change. Creating an implementation infrastructure to advance the adoption of innovations identified by safety research will foster and encourage the traffic safety culture in this nation.

Challenges and barriers

The most important challenge to successful implementation for fostering a culture of traffic safety will be to acknowledge and accept that a purposeful, systematic process is required. A second and related major challenge will be to use the elements of the implementation infrastructure to assist in institutionalizing the applied research results. The third major challenge will be to reserve resources to accomplish the tasks of implementation—expertise, time, tools, and funding. Each of these major challenges must be addressed at the senior decision-making level.

If change is to happen on a broad scale, there is no other choice but to subscribe to a viable implementation effort.

Many state DOTs are currently trying to overcome these major challenges and, by trial and error, some have taken years to put various implementation strategies in place. Safety research activities leading to an enhanced traffic safety culture can incorporate the elements of the implementation infrastructure from the outset of its efforts, leaping over the incremental processes of the past.

In addition to the challenges of creating an implementation infrastructure, there are two barriers that are also important to discuss. The first barrier is that there is relatively little work done on performance measures for implementation efforts. In fact, only at the time of this writing are state DOTs examining a performance measure system for comprehensive research activities through work being done by NCHRP. Some states' DOT research programs regularly develop a return-on-investment or a cost-benefit ratio for their research programs. However, for many, quantitative assessment of the benefits of implementation activities have been elusive, at best. An effort to determine the benefits of the work done to implement the traffic safety culture will be very useful, yet the implementation activities should not be thwarted because such tools are not in place. Yet even without such quantitative figures, if implementation activities assist in increasing safety research improvements by only a few percent, the costs of the implementation will be small compared to the overall benefits.

Implementation of research results has a second and unique barrier that must be overcome. This barrier is much like the concept of reaching critical mass (Rogers 2003). Houghton Mifflin Company defines critical mass is the smallest amount of fissionable material that will sustain a nuclear chain reaction at a constant level. Similarly in the social sciences, the concept of critical mass is fundamental to understanding a wide range of human behavior because an individual's actions often depend on perception of how many other individuals are behaving in a particular way (Schelling 1978). As in the nuclear and social sciences contexts, the process of implementation must reach a point where it will continue at a constant level. A critical mass of supporters and users is necessary to sustain broad deployment. Without reaching critical mass, the implementation efforts will struggle and only partially realize the benefits envisioned. The key is to use the implementation infrastructure to assure that critical mass is achieved. As shown in Figure 2, once researchers, research and senior managers, early adopters, opinion leaders and champions have endorsed or used the research result, incorporating influential staff open to change begins the stage at which critical mass can occur. When these influential users apply the research results or innovation, the remaining user community will follow. In this context, one of the benefits of the AAA Foundation for Traffic Safety highlighting the goal of enhancing a culture of traffic safety is to assist in creating the critical mass poised to increase change.

Furthermore, a detailed and valuable treatment of critical mass for deployment of innovations is contained in Rogers' work *Diffusion of Innovations, 3rd edition*. Understanding the process of critical mass will strengthen the approach and results of creating an effective traffic safety culture.

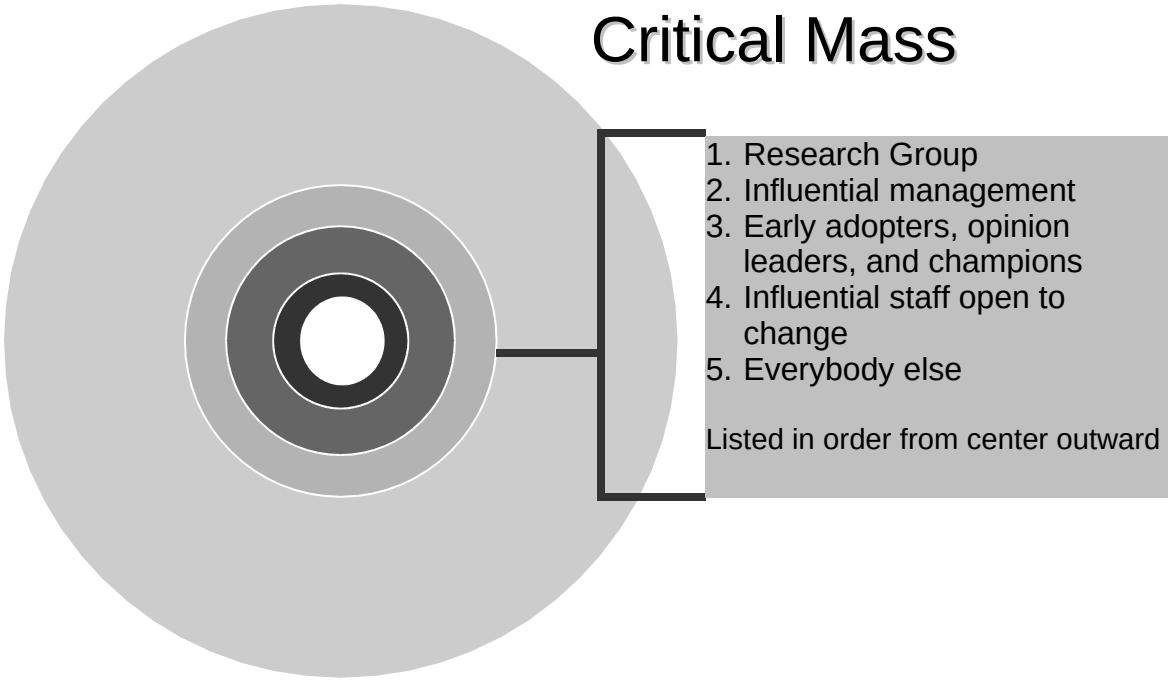


Figure 2. Critical mass for implementation.

These challenges and barriers presented are not insurmountable. If they are identified in the process of implementation planning, much can be done to mitigate their effect, and solutions to them can be developed.

Summary and recommendations

A focus on implementation must occur for traffic safety culture research activities to create positive and timely change. This focus must include addressing implementation of research results in a systematic manner. Such a systematic approach taken by the organizations sponsoring and encouraging traffic safety research will form an implementation infrastructure. The implementation infrastructure will in turn promote more effective application of research results thus fostering innovation and improvements and enhancing a traffic safety culture for this nation.

The goal of establishing an implementation infrastructure is to realize research benefits more efficiently and more effectively. Creating an infrastructure to address implementation processes allows the implementation to occur in a more rational and comprehensive manner. The infrastructure contains five primary elements: technology, people, marketing and communications, and implementation tools as well as levers that increase the effectiveness of the other four elements. Each of the elements of the implementation infrastructure is composed of well proven strategies for implementation.

These elements and strategies are:

1. Technology
    - The technology "push"
    - Demonstrations and pilots
    - Benefits of the research result—meeting users' needs
2. People
    - Champions
    - Qualified people in lead roles
    - Early involvement of the users
3. Marketing and communications
    - Message
    - Networks/established channels
4. Implementation tools
    - Implementation plan
    - Identifying successful innovations
    - Web portal
    - Implementation packages
5. Levers
    - Partnerships and alliances
    - Committed funding
    - Coordinating function
    - Senior management support

Each of the strategies is a best practice method for increasing the potential for successful implementation of research results. The strategies are provided so that traffic safety research activities can incorporate practical implementation methods from the earliest stages of the research, thus maximizing the use of research findings.

Every research sponsor can be a positive factor in promoting implementation of research results. Through sponsors applying the strategies that are discussed in this paper, an implementation infrastructure will emerge. This infrastructure will enable the advancement of application of innovations and improvements thus advancing the culture of safety.

Sponsors of research can review the infrastructure strategies and determine the extent to which they can provide the necessary resources and procedures that will promote implementation. Federal agencies sponsoring traffic safety research such as the Federal Highway Administration or the National Highway Traffic Safety Administration are in excellent positions to enhance their present efforts or to incorporate the implementation strategies discussed in this paper into their

programs. These agencies can contribute substantially by setting the example for requiring implementation strategies to be accomplished in association with the research they sponsor or results they promote. Organizations such as the AAA Foundation for Traffic Safety can provide valuable leadership by encouraging systematic implementation practices.

An implementation infrastructure will promote more effective implementation of research results. In addition, the implementation infrastructure will increase the potential for worthy research results to be applied to problem areas within traffic safety. This will promote changed behaviors through adoption of new products, processes, and methods that will address the dramatic need for improvement within traffic safety today.

References

Bikson, T. K., S. A. Law, M. Markovich, and B. T. Harder. 1996. *NCHRP Report 382, Facilitating the implementation of research findings: A summary report*, Transportation Research Board, National Research Council. Washington, DC.

Deen, T. B., and B. T. Harder. 1999. *NCHRP synthesis 280, Seven keys to building a robust research program*, Transportation Research Board, National Research Council. Washington, DC.

Harder, B. T. 2003. *NCHRP synthesis 312, Facilitating partnerships in transportation research*, Transportation Research Board, National Research Council. Washington, DC.

Harder, B. T., and R. J. Benke. 2006. *NCHRP synthesis 355, Technology transfer: Successes, challenges, and needs*, Transportation Research Board, National Research Council. Washington, DC.

Hodgkins, E. A. 1989. *NCHRP synthesis of highway practice 150: Technology transfer in selected highway agencies*, Transportation Research Board, National Research Council. Washington, DC. Dec. 1989, p 3.

Rogers, E. M. 2003. *Diffusion of innovations*, 5th edition. New York: Free Press.

Schelling, T. C. 1978. *Micromotives and macrobehavior.* New York: Norton.

Schmitt, R. P., E. A. Beimborn, and M. J. Mullroy. 1985. Technology transfer primer, FHWA-TS-84-226. University of Wisconsin, Madison. July 1985.

Wallace, C. E., J. A. Anderson, and E. M. Wilson. 1998. Transportation technology transfer: A primer on the state-of-the-practice, *Transportation Research Circular 488*, Transportation Research Board, National Research Council, Washington, D.C. May 1998. [Online]. Available: http://Gulliver.trb.org/publications/circulars/circ488/circ488_index.pdf.

Watkins, R. K. 1974. *NCHRP synthesis of highway practice 23: Getting research findings into practice, transportation research board.* National Research Council. Washington, DC, p. 1.

Biographical statement

Barbara Thomas Harder specializes in research and technology management, and one of her focus areas is implementation of research results and innovations. As a consultant, she has been a

contributing author to studies examining research implementation activities in public-sector transportation for nearly twenty years. Ms. Harder currently is part of a team preparing an innovation infrastructure for the Pennsylvania Department of Transportation (PennDOT) Research Division; she works with FHWA to facilitate the Turner-Fairbank Highway Research Center laboratory expert/peer review meetings and recently completed the National Cooperative Highway Research Program (NCHRP) Synthesis 355, Technology Transfer Successes, Challenges, and Needs with Robert Benke. In the recent past she has performed work on research partnerships, information management, and NCHRP Synthesis 280—7 Keys to Building a Robust Research Program with Thomas Deen.

Prior to 1988, Ms. Harder was PennDOT's Director of Research and Special Studies and worked for a transportation consulting firm and a large-scale computer systems manufacturer and vendor. She has an MBA in Technology Management and a BA in Mathematics with a concentration in Physics. She is a member of Transportation Research Board (TRB) Committees on Conduct of Research, Strategic Planning, and Library and Information Science for Transportation; in January 2006, Ms. Harder was recognized by the TRB Technology Transfer Committee for her contribution to the development of technology transfer tools. Ms. Harder is also a member of the Women's Transportation Seminar, an associate member of ASCE, and a member of its Transportation and Development Institute Research Committee.

Is a strong safety culture taking root in our highway agencies?

Geni Bahar and Nesta Morris

iTRANS Consulting

Introduction

The purpose of this paper is to present an exploratory investigation into the relationship between safety legislation for transportation planning and the nature of the safety culture that has developed in highway agencies. An effective and efficient transportation system has long been a national priority, and safety is a major goal of the transportation system, but has a strong safety culture taken root in our highway agencies? This paper investigates the major transportation and safety related legislation of the last fifteen years and considers the effects of legislation on the safety culture of highway agencies, especially State Departments of Transportation (DOTs).

During the last 15 years, legislation has moved purposefully towards making safety a central, explicit, comprehensive, and integrated part of transportation planning. Safety management systems have advanced. Data and analytical tools have been improved and refined, and the effects of countermeasures have become better understood. The recently enacted Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU) builds on previous legislation in giving specific and increasing recognition to safety issues.

Major highway agencies such as DOTs, metropolitan planning organizations (MPOs), transit agencies, and local governments are usually large, well-established organizations where change may not come naturally. How do agencies vary in their commitment to safety? Has safety become a more explicit and fully integrated part of all aspects of transportation planning?

Safety legislation can lay out requirements for highway agencies to bring about the implementation of the legislation and can support those requirements with the carrot of project funding and the stick of penalties, but the legislation's ultimate success or failure in reducing fatalities and injuries is likely to be affected by the ability of individual agencies to implement the legislation effectively and to sustain it by means of a strong safety culture. Such a culture would accept and adopt the legislation in the full spirit intended and would succeed in entrenching safety as its central and permanent focus for decision making.

Understanding the relationship between legislation and safety culture

A preliminary literature review reveals very limited information on the relationship between legislation and safety culture. The gap in our knowledge may be attributed partly to the difficulties associated with considering the complex and abstract issues involved in discussing "safety culture," but suggests that we need to start right at the beginning with our investigations.

The goal of understanding the relationship between safety legislation and the safety culture within DOTs will require analysis of a large number of issues:

1. Definition of safety culture for highway agencies.
2. Measurement of the safety culture of highway agencies.
   - appropriate methods for quantifying safety culture.
   - data required for quantifying safety culture.
   - criteria that define and quantify a strong/weak safety culture.
   - specific measures or attributes of safety culture that are strong predictors of success in reducing fatalities and injuries.
3. Developments in safety legislation.
   - how highway agencies have responded to past legislation, for example, to safety management systems (lessons learned), including case studies.
   - how highway agencies are responding to current legislation (lessons learned), including case studies, and how agencies are monitoring the effects of SAFETEA-LU in reducing fatalities and injuries in relation to the type of safety culture found within State DOTs.
   - how other (nonlegislative) developments have affected the safety culture of highway agencies.
4. The nature of the safety culture currently found in highway agencies.
   - major issues that are affecting the way safety culture is evolving.
   - ways in which some agencies have created and maintained a successful safety culture.
5. Lessons learned about highway agencies' ability to change their safety culture, including case studies.

The task of finding answers to the issues listed faces specific challenges including: the need to define institutional safety culture, the lack of past research, the lack of past measurements of safety culture and its relationship with legislation, the difficulties involved in making culture a concrete, quantifiable issue, and the need to ensure that the approach is productive and makes a constructive contribution to improving highway safety.

Objectives of this paper

The issues listed above are numerous and ambitious. This paper briefly discusses just three of the issues listed:

1. Definition of safety culture for highway agencies.
2. Measurement of the safety culture of highway agencies.
3. Developments in safety legislation (1991 to 2005).

The paper then discusses examples of the safety culture of highway agencies in Sweden, England, and the United States (national and state levels).

A definition of safety culture for highway agencies

We must start by asking what we mean by institutional safety culture and the safety culture of a DOT. If we were describing the safety culture of the general public, we might point to the public's widespread acceptance of safety measures such as seat belts and zero tolerance for impaired drivers. A positive indication of how the public's safety culture has changed is the surprise that one experiences in 2007 realizing that in the early 1980s, fewer than 20 per cent of drivers used seat belts. A negative indication of how the public's safety culture has changed is today's need to be concerned about aggressive drivers.

At the simplest level, the safety culture of an organization is "the way we do things around here." Historically, industries that are complex and high risk (such as aviation, nuclear power, mining, chemical processing, and manufacturing) have given the most consideration to safety culture. These industries emphasize the importance of establishing a successful safety culture that thinks about safety constantly, recognizes that an explicit safety approach will prevent accidents, and makes a persistent effort to seek improvements.

The International Atomic Energy Commission Agency (IAEA) definition of safety culture is one of the simplest:

> *Safety culture is that assembly of individual and organizational characteristics and attitudes that ensures that safety is regarded as an overriding priority and that safety issues receive the attention warranted by their significance. (IAEA 1991)*

Measurement of the safety culture of highway agencies

In assessing the safety culture of DOTs, we want to establish where the culture stands on a continuum from strong to weak and where the culture can be improved and strengthened. There are no standardized or "off the shelf" tools for measuring the position of an organization's safety culture, but surveys and questionnaires have been widely used to assess safety culture within various industries (nuclear power, chemical, construction, manufacturing, etc). Qualitative methods, including focus group discussions and case studies, can also be used.

Several attributes of safety culture may be measured, including:

- Individual and group values, perceptions, attitudes, and behavior regarding safety.
- The commitment of upper-level management to identifying safety as a core value, acting as a "safety champion," providing resources and visible support to safety programs, and maintaining support when resources are scarce or when difficulties arise.
- A clear mission and vision statement with commonly understood and agreed goals.
- The nature and quality of the relationship with other agencies working on safety.

- The organization's safety management system.
- The quality of data and reporting systems (the organization should be a “reporting culture”).
- The quality of training programs.
- The level of competency of the organization’s safety programs.
- The involvement of all employees.
- The encouragement of new ideas.
- The organization’s willingness and ability to learn proactively and to adapt as necessary to change.
- Accountability.

The safety criteria listed above are often discussed in relation to safety management systems. They are clearly tabulated as appraisal criteria in the National Cooperative Highway Research Program’s report on Integrated Safety Management Process (Bahar et al. 2003).

In the late 1990s, Zogby, Knipling and Werner noted that the United States has had experience with safety management systems since 1966 (Zogby, Knipling, and Werner undated). An SMS “can be improved through better management,” but needs management that goes beyond updating previous work. “Management must consider major events and changes occurring outside of the organization and/or jurisdiction” and must be “action oriented, with a strong emphasis on practical results.” Zogby recommends that the leaders of management set the mission statement (because it is the leaders who allocate resources), and he stresses the importance of the mission statement being communicated through every level of the organization (Zogby undated).

No widespread formal studies of the safety culture of DOTs have been found. Informal attempts have been made to assess the safety culture of DOTs by examining the organizational chart (to see, for example, how many designations are specifically for safety) and also by examining the web site and other material produced by the DOT. It may be assumed that a highly open and transparent DOT (with, for example, clearly named contacts and ready access to their phone numbers and email addresses) is likely to have a strong safety culture and “nothing to hide.”

Development in safety legislation—1991 to 2005

Legislating for safety has been a long-term and ongoing process. Since 1991, there have been three major Acts: the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA), the 1998 Transportation Equity Act for the 21st Century (TEA-21), and the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU.) They are briefly described below.

Intermodal Surface Transportation Efficiency Act (ISTEA) 1991

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 moved the historical focus of highway and transit programs away from construction, capacity, and congestion. The Act changed the emphasis towards mobility and access, system performance, and consideration for the environment and quality of life. Under these three headings, ISTEA required statewide transportation plans to consider 23 planning factors (and metropolitan plans to consider 16 planning factors).

The Act did not specifically mention safety as part of the planning process but mandated six comprehensive management systems including a Safety Management System (SMS) as a prerequisite for funding. The SMS was part of the strategy to improve the management, operations, and safety of the highway system through improved data analysis and collection, through improved coordination, cooperation, and communication among agencies, and through the development of collaborative strategic plans (Depue 2003).

The emphasis of the ISTEA SMS was on bringing together all the agencies involved in safety and coordinating with other systems and activities (Zogby undated). A 1994 Federal Highway Administration (FHWA) tour to investigate highway safety management practices in Japan, Australia, and New Zealand noted the emphasis these countries put on networking and consensus building among government, industry and citizen groups seeking to improve safety.

Several States embraced the development of an SMS and the associated opportunity to obtain funding while several others struggled with the links between the SMS and federal funding. The SMS (and most of the other mandated management systems) became optional in 1995 under the National Highway System Designation Act.

Transportation Equity Act for the 21st Century (TEA-21) 1998

In 1998, the Transportation Equity Act for the 21st Century (TEA-21) called for comprehensive safety consciousness. The Act required state DOTs (and MPOs) to "increase the safety and security of the transportation system for motorized and nonmotorized users." This was the first time that safety became an explicit part of transportation plans. "Prior to TEA-21, safety was sometimes a prominent factor in project development and design, but this legislation calls for safety consciousness in a more comprehensive, system-wide, multimodal context" (FHWA 2001a). The Act did not, however, separate safety from security and did not require specific reports on how safety was addressed. Under TEA-21, an SMS remained optional.

In 2003, Depue reported on the adoption and implementation of SMSs (Depue 2003). She noted that 26 states had an active SMS approach in 2001 and four states had no SMS process. She concluded that "the opportunity to put the SMS process into practice is being lost in the United States."

Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU) 2005

The Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU) became law in 2005. SAFETEA-LU has a strong focus on integrated, comprehensive safety planning and makes greatly increased funding available. The Act establishes the Highway Safety Improvement Program (HSIP) as a core program and nearly doubles the funds available for infrastructure safety and comprehensive, strategic highway safety planning. The purpose of the HSIP is to reduce fatal and serious/life changing crashes. The program includes planning, implementation, and evaluation of safety programs and projects.

Strategic Highway Safety Plans (SHSP) are a new requirement (under the HSIP) and must be fully linked and integrated with the transportation planning process and associated plans. (From July 1, 2007, all newly adopted statewide and metropolitan transportation plans must be consistent with SAFETEA-LU planning provisions.)

An SHSP is a data-driven, four- to five-year comprehensive safety plan that provides a comprehensive framework, statewide coordination, and specific goals and objectives for reducing highway fatalities and serious injuries on all public roads. The SHSP is a cooperative process that includes input from public and private safety stakeholders.

SAFETEA-LU gives certain safety issues (work zones, older drivers, and pedestrians, including children walking to school) special emphasis in the Act. Security is handled separately. Flexibility is an important part of SAFETEA-LU's approach, allowing states to examine their own circumstances and to concentrate on their most critical safety needs.

The FHWA's view is that "starting the development of an SHSP should not be an overwhelming or arduous task" (FHWA 2006). The American Association of State Highway and Transportation Officials' (AASHTO) "Self-Assessment Tool" (AASHTO 2004) could be used to as one approach to initiate the process and to assess whether a state's current safety efforts are strong or in need of development.

Many of the SAFETEA-LU provisions entail (or may lead to) cultural shifts in the agencies working with the legislation. In the long run, successful achievement of the goals of the legislation will depend on the ability of the appropriate agencies to respond and change. The FHWA and AASHTO have recently completed a SAFETEA-LU workshop during which state officials raised a specific example of an area of concern: collaborating with resource agencies in the area of strategic planning. The workshop found that, "Some states have had difficulty engaging resource agencies during planning stages. This may be due in part to their lack of familiarity with the planning process, inadequate staff capacity, disagreement about the level of detail necessary, reluctance to waive project-level reviews, or a history of conflict or distrust among agencies. Culturally, some agencies view themselves as "regulatory" rather than "planning" organizations. Moving to a more strategic planning approach often takes considerable time" (Cambridge Systematics 2006).

Additional challenges facing the implementation of SAFETEA-LU include the need for high quality data for improved analysis and the need for committed leaders able to guide the development of SHSPs, promote shared goals, and work effectively with other agencies: "SHSPs need champions that effectively break down stovepipes" (Cambridge Systematics 2006).

Examples of the safety culture of highway agencies

As mentioned earlier, there is very limited information on the safety culture of highway agencies and how that safety culture is related to legislation. This section of the paper first examines two approaches in Europe (Sweden and England) and then examines information from the United States.

The example of Sweden demonstrates the safety culture effects of national-level legislation in which safety is a long-term commitment and a complete priority. The example from England demonstrates the effects of a national initiative that encouraged local authorities to improve safety through a project that both improved short-term safety and created a foundation for a culture change through increased staff motivation and an emphasis on institutional linkages.

Sweden

In1997, the Swedish Parliament passed an Act stating that Sweden's long-term road safety goals were zero fatalities and zero serious injuries. This goal is known as Vision Zero. Vision Zero gives a very clear message to highway agencies that almost every feasible countermeasure designed to reduce the number of fatalities and serious injuries must be implemented. Under Vision Zero, cost-benefit analysis and the most cost-effective solution are not the issue: safety is paramount, and cost and mobility take second place.

It is assumed that drivers make errors and that it is the responsibility of Swedish highway agencies to anticipate the errors and to adapt the road system to bring about the desired goal of zero fatalities and zero serious injuries. This approach demands the long-term commitment of highway agencies, strong leadership, and a strong safety culture that can sustain the processes to achieve the long-term goal.

England

The Gloucester Safer City project provides an example of how the adoption of a new approach and a change in safety culture can improve safety at the small-city level (Department for Transport 2002). The project was part of the British government's 1996 "Safe Town Initiative."

Gloucester is an English city of 100,000 inhabitants. The project's target was a 33% reduction in road casualties by 2002. The approach was based on: a concentrated team effort; taking a systematic city-wide view; implementing proven safety measures; and conducting customized consultations with the residents of each area affected. In particular, highway authorities, district councils and the public worked closely together under a management structure set up especially for the project. Deaths and serious injuries decreased by 38% (the exact time period is not clear).

The report lists four lessons, all of which involved cultural change:

1. The enthusiasm of the city's officials and elected members was essential, especially when other agencies were involved in the project. "Enthusiastic staff can help to keep other agencies committed."
2. The systematic application of a formally adopted and published urban "safety management strategy" was a great help in guiding the project's progress.
3. The team placed priority on good consultation including (although time-consuming) clear feedback to the public.
4. The management structure was effective and essential to the success of the project. It succeeded in bringing about close cooperation between county authorities and city authorities.

United States

National level

The FHWA and AASHTO's goal is to reduce highway fatalities by a fifth by 2008 (AASHTO 2005). A fatality rate of 1.0 per 100 million-vehicle-miles-traveled would reduce the number of fatalities to about 30,000 per year.

This approach illustrates a difference in the safety cultures of the United States and a country like Sweden. Whereas the United States accepts a certain number of fatalities and injuries on highways and mandates a desired percentage decrease in death and destruction, Sweden's stated goal is that no one should die on a Swedish road. Sweden's safety culture is based on the principle that drivers make mistakes and it is unethical for authorities to fail to take whatever measures are necessary to reduce crashes. In the United States, "primary responsibility for safe driving rests with the driver. The Federal government provides standards and regulation for the design and construction of both vehicles and roadways, but it is up to the driver to ultimately avoid errors such as running off the road" (FHWA 2005).

State level

State fatality rates in 2003 varied from less than 1.0 fatality per 100 million-vehicle-miles-traveled in Vermont, Massachusetts, Connecticut, and New Hampshire to more than 2.0 fatalities per 100 million-vehicle-miles-traveled in South Carolina, Idaho, Arizona, Arkansas, Louisiana, Mississippi, South Dakota, and Montana. The safety culture of the highway agencies of these states is only one of many factors behind the range in fatality rates, but it is one worth exploring, especially for the role that a strengthened safety culture could play in reducing the fatality rate in the states with the greatest challenges.

The FHWA's review of Highway Safety Improvement Programs (HSIP) in six states noted nine elements common to states with the most effective safety program. These elements are quoted (in italics) below (FHWA 2001b):

1. *The establishment of safety as a major goal of the agency and the commitment of the highest officials*. For example, states with effective programs enjoyed the active support of the state governor.

2. *A good multidisciplinary safety-management process with a strong component for roadway safety.* States that had continued their SMS after 1995 when having an SMS became optional, were described as "highly effective" with a clear focus on safety and a culture in which different disciplines can work well together.
3. *Emphasis on safety in all projects*. States with a good SMS found TEA-21's requirement that safety must be fully incorporated into state and metropolitan transportation planning straightforward.
4. *A designated safety division or a safety engineer/coordinator within the state DOT.* A focal point leads to an effective safety program.
5. *A designated safety section or safety engineer/coordinator in each regional office of the state DOT.* Similarly, a focal point leads to an effective safety program at the regional level.
6. *Community-based traffic safety programs*. The participation of local government and the community level in the safety program will include minor collectors and local streets where many crashes occur.
7. *Efforts to assist localities*. Local agencies usually lack safety staff and expertise.
8. *Use of current technologies.*
9. *A Traffic Records Coordinating Committee*: a multiagency team to oversee and advance the data-related issues.

Conclusions

Transportation legislation has made safety an increasingly important focus for transportation planning activities in the past 15 years. Consideration of safety has become increasingly explicit. Legislation has encouraged or insisted on giving safety priority through better data, better analysis, better reporting systems, and the adoption of a structured comprehensive approach, such as a safety management system with a clear mission and vision statement. Challenges have included using project funding as a carrot, encouraging different agencies to work together, defining responsibilities and accountability, and walking the line between offering the flexibility required for differing circumstances and missing opportunities when some agencies do not take up the approach advocated.

Safety legislation naturally deals with the relatively "hard" aspects of transportation planning. To maximize the benefits of legislation, we need to consider the impact of legislation on agencies' "soft" culture aspects. The "soft" aspects include: (1) individual and group values regarding safety, (2) making safety the major goal of the agency, (3) how ambitious the targets for crash reduction should be, (4) the commitment of leadership, (5) the nature and quality of the relationships with other agencies involved in safety including different levels of government (including support for local government's safety efforts), (6) political agendas, (7) the focus of state research organizations, (8) and informing and consulting the public. Then there are other intangible, but important, issues like the agency's energy and enthusiasm, or action and commitment, and the agency's ability to sustain the safety effort beyond the present champions and participants.

Legislation cannot succeed unless it is embraced by the relevant agencies and unless agencies are willing and able to change where necessary. We do not know whether a strong safety culture is taking roots in our highway agencies. The area is little explored. It should, however, be possible to fill the gap. It should be possible to improve our understanding of the nature of the safety culture within DOTs and other public agencies, and to improve our understanding of the relationship between safety legislation and institutional safety culture. To build a world-class safety culture, we need to start by understanding where we are today. Such an understanding will help to promote change in the safety culture of the organizations in the front line of working towards a safer transportation system with fewer fatalities and fewer serious injuries.

Next steps

It is important to understand why some highway agencies become overall success stories, why others have problems creating a safety culture, and how agencies can move from a weak safety culture to a strong one. It is important to understand how the development of an intrinsically strong safety culture may be encouraged by safety legislation and may lead to a reduction in crashes.

A detailed study of the safety culture of highway agencies, such as state DOTs, would help us to understand safety culture and the role of safety culture in helping to make safety legislation a success. This study could be closely tied to the recent SAFETEA-LU legislation. The objectives listed in this paper provide a starting point for the investigation. One approach might be to work closely with states, such as Iowa, Arizona, New Jersey, Kentucky, and Minnesota, known to have made special commitments to safety in their planning. A follow-up and initial approach might be to design a questionnaire and to conduct focus groups as a basis for providing insights from across the country.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Self Assessment Tool http://safety.transportation.org/assessment.aspx.

———. 2005. *AASHTO Strategic Highway Safety Plan: A comprehensive plan to substantially reduce vehicle-related fatalities and injuries on the nation's highways*. http://safety.transportation.org/plan.aspx.

Bahar, G., M. Masliah, C. Mollett, and B. Persaud. 2003. *Integrated safety management process*. National Cooperative Highway Research Program. Washington, DC: Transportation Research Board.

Cambridge Systematics. 2006. *SAFETEA-LU Planning Provisions Workshop*. Federal Highway Administration, American Association of State Highway and Transportation Officials Standing Committee on Planning. (http://www.transportation.org/sites/planning/docs/FINAL%20REPORT%20FR1_SAFETEA-LU%20Plan%20Prov%20Workshop.pdf).

Department for Transport. 2002. *Report on the Gloucester Safer City Project*. United Kingdom. http://www.dft.gov.uk/stellent/groups/dft_rdsafety/documents/page/dft_rdsafety_504563.hcsp.

Depue, L. 2003. *Safety management systems: A synthesis of highway practice*. NCHRP Synthesis 322. National Cooperative Highway Research Program. Washington, DC: Transportation Research Board.

Federal Highway Administration (FHWA). 2001a. *Transportation safety planning: Safety-conscious planning*. Transportation E-Circular E-C025, January 2001. http://www.fhwa.dot.gov/Planning/scp/ec025scp.htm.

———. 2001b. *National review of the highway safety improvement program*. http://www.tfhrc.gov/pubrds/02mar/04.htm.

———. 2005. *Roadway Human Factors and Behavioral Safety in Europe*. http://bd.mot.gov.il/NR/rdonlyres/2A607F45-C54C-4077-8E56-ADB41319EBB7/0/RoadwayHumanFactorsandBehavioralSafetyinEuropecd111.pdf.

———. 2006. *Strategic highway safety plans: A champion's guide to saving lives*. Interim guidance to Supplement SAFETEA-LU requirements. http://safety.fhwa.dot.gov/safetealu/shsppreview.htm#introduction.

International Atomic Energy Agency (IAEA). 1991 *Safety culture: A report by the International Nuclear Safety Advisory Group*. SAFETY Series No. 75-INSAG-4. Vienna.

Zogby, J. undated. *A systems approach to highway safety management*. (A safety management system reference manual).

Zogby, J. J., R. R. Knipling, and T. C. Werner. Undated. *Transportation safety issues*. A3B01: Committee on Transportation Safety Management. Transportation Research Board. http://onlinepubs.trb.org/onlinepubs/millennium/00132.pdf.

Biographical statements

Geni Bahar, P. Eng., has over twenty-seven years of experience as a civil engineer specializing in the area of traffic and road safety engineering Geni has led multidisciplinary teams in projects where her safety engineering research experience has allowed her to bring safety explicitly to the practitioners' world.

In recent years, Geni served as Principal Investigator for a high profile research project for the Transportation Research Board National Academy: NCHRP 17-18 "Integrated Management Process to Reduce Highway Injuries and Fatalities Statewide". The outcome of this project provide the framework and tools for the implementation of integrated and comprehensive safety programs to support the AASHTO Strategic Safety Plan for the nation, and to apply the AASHTO Guides (Series 500: Tools for Life); as well to develop State Strategic Highway Safety Plans, as defined by the SAFETEA-LU.

Other recent projects, for which Geni has served as Principal Investigator are NCHRP 5-17 "Safety Evaluation of Permanent Raised Pavement Markers" (Report 518), and NCHRP 17-28 "Pavement Marking Materials and Markers: Safety Impact and Cost Effectiveness (Wed Document 92). She is currently serving as Principal Investigator to NCHRP 17-27 "Prepare Parts I and II of the Highway Safety Manual," and TCRP A-30 "Improving Pedestrian and Motorist Safety Along LRT Alignments" and Co-Principal Investigator for the multiyear initiative of the Federal

Highway Administration for the research and functional specification development for the ***Safety Analyst*** software tools.

Currently, Geni is a member of TRB Committee for Operational Effects of Geometrics, a member of the TRB Task Force for the Highways Safety Manual, a member of TRB Committee for Safety, Data, Evaluation and Analysis, a member of ITE International Traffic Safety Council, a member of the Transportation Association of Canada's Standing Committees for Road Safety, and Geometric Design Standard.

Nesta Morris was educated in England where she graduated with a MSc (Econ) in Urban and Regional Planning from the London School of Economics (London University). She has over twenty-five years of research and consulting experience in urban planning and transportation studies. Her international experience includes England, Swaziland, South Africa, New Zealand and Canada.

In Canada, she participated in the creation of a framework designed to assess the impact of civil engineering measures on accident rates and road safety in Ontario. This led to her involvement in the research for the first edition of the Highway Safety Manual for the National Cooperative Highway Research Program. She has always been interested in multidisciplinary work and new approaches and has had the opportunity to work on a wide range of subjects and projects.

Briefly, these include:

- Public transportation planning in a recently deregulated environment (New Zealand).
- Issues facing local authorities undergoing major changes; the incorporation of a new area into an existing regional transportation authority; community participation; guidelines for professionals adapting to new approaches (South Africa).
- Innovative studies of the methodological issues involved in cross-cultural surveys (South Africa).
- Implications of urban population expansion for transportation planning infrastructure requirements (South Africa).
- Management of the field work for the Swaziland Census Preparation Project—a project conducted for the United Nations to test the feasibility of conducting an accurate census in a developing country in Africa (Swaziland).