

**The Conceptual Domain of SMARTRISK**  
**A Think Piece**

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## Introduction

At a theoretical level, advances in mathematics, physics and other disciplines have led to developments in probability theory, statistical analysis and chaos theory. Risk perception has changed. These innovations have had profound implications on how risk in general is understood and measured. At a more practical level, SMARTRISK's area of interest, its logical domain so to speak, is at the intersection of risk management, injury prevention and safety. It has contributed to new ways of thinking, and developed innovative programs of research and application, which learn from and contribute to the most advanced thinking in all three areas.

There are fresh policy directions that emerge from these new ways of thinking, but there is also some confusion about the connection between the SMARTRISK approach to these issues and other perspectives on them. Clarifying and organizing the ideas that stand behind SMARTRISK's approach and comparing and contrasting them with the many other ways of thinking about these issues will help to clear the way forward in the areas of special interest to SMARTRISK. It may also have consequences to a better understanding of the place of risk and its management in other areas of government policy.

As SMARTRISK defines the direction of its future activities and identifies where it will concentrate its efforts over the next five years, we expect the results of this research to inform these discussions. The future direction of SMARTRISK will become clearer as it finds an appropriate logical domain for its connections with safety, risk, and injury.

Sholom Glouberman and his group have completed several policy research projects on population health and the policy consequences associated with it for CPRN. They have also considered the connections between population health and sustainable development. These are two other "big picture" frameworks that have been in transition and have had an impact on policy direction. The SMARTRISK approach has implications for the other two approaches. It considers injury prevention at the population as well as the individual level. Its study "The Economic Burden of Injury in Canada" has implications for the sustainable development of social capital in Canada. This research project is a step in the direction of clarifying the areas where these three approaches overlap and where they differ from each other. SMARTRISK has supported the research team in their initial efforts to consider approached to risk management

## The Objectives of the Research Project

- **To provide an analysis of the risk and risk management literature.**

The risk and risk management literature is extremely large and growing constantly. It is clear that not all this literature is relevant to the particular area of interest of SMARTRISK. We have called this area of interest the "SMARTRISK domain" and our concern is to mark out its boundaries and describe its contents. Once we understand the boundaries, there are two parts to our analysis. The first is to identify some seminal papers and books in the areas that impinge on the SMARTRISK domain and the second is to trace the trajectory of thinking behind it that can help SMARTRISK remain at the leading edge of thinking about unintentional preventable injuries.

- **To identify a framework for understanding recent advances in the theories**

### **surrounding risk and risk management.**

Our analysis requires a framework that first of all distinguishes the SMARTRISK domain of interest from others. Much of the risk literature is about financial risk, which though at times illuminating, is of only passing concern to the risk of injury. A great deal of the literature about health risk is about risk of illness rather than injury and once more can be useful but is often not to the point. The criteria for exclusion as well as inclusion in the area can then be of some assistance to SMARTRISK. Once the relevance of this leading edge literature is established, its contribution to SMARTRISK thinking can be articulated.

- **To describe the similarities and differences between approaches to safety, injury prevention, and risk management and to propose an integrating conceptual framework among these approaches. To provide a translation and classification of the concepts of risk management as it can be applied to injury prevention.**

In the area of unintentional preventable injuries the three fields of endeavor that directly bear upon the SMARTRISK domain are safety, injury prevention and risk management. Our interviews suggested that there is some overlap among them and that there is often rivalry among their practitioners. They compete for funding, for media attention and for leadership in the field. All three fields contribute significantly to the SMARTRISK domain. A major task of this project was to find a way of identifying the main aspects of their contributions, indicating where they overlap and where they are distinct. This will provide a basis for understanding where they have competing and perhaps incompatible views about injury, for example with very different degrees of risk tolerance and where their views are complementary, for example in the recognition of the need for environmental safety standards. A second consequence is more critical. A good framework which displays their very different contributions to the SMARTRISK domain may help them recognize that though different, all three fields can and do make genuine complementary contributions to the prevention of unintentional injury.

- **To help SMARTRISK articulate and show the relevance of its unique perspective in these areas. This will increase its capacity to explain its contribution to policy makers, researchers and organizations concerned with risk management and preventable injury. This study will assist in clarifying and articulating the values of SMARTRISK and thereby guide internal discussions about future research and programming initiatives and projects.**

A good conceptual framework will allow SMARTRISK to distinguish itself from others in the same field while at the same time recognizing their contributions. We expect that a clear understanding of the logical domain which SMARTRISK occupies, its special place in the prevention of unintentional injury, its relationship with the areas of risk management, injury prevention and safety, will allow it to recognize and articulate the values which underlie its approach.

- **To inform SMARTRISK in the development of products such as, programming, future research initiatives, social marketing initiatives.**

Just as the understanding of SMARTRISK's values is made clearer by a framework, so is its capacity to decide where to concentrate effort in the development of new initiatives.

The decision to pursue a new direction or product can be informed by whether it is already in the SMARTRISK domain or requires a reexamination of its boundaries. More critically, bringing together the characteristics of SMARTRISK with the ideas that contribute to it can spark new ideas and directions for the organization and its individual, organizational and government funders. The achievement of these two objectives depended on close collaborative work between the research team and SMARTRISK.

- **To complete a research project which explores and clarifies the connections between population health, sustainable development and risk management in order to inform policy decision-making.**

“Population health,” “sustainable development,” and “risk management” are labels that describe three related “big picture” analyses of broad social issues, which involve economic, socio-cultural, and environmental dimensions. The purpose of each analysis is to contribute to a better understanding of the human experience with the express concern of influencing public policy so as to maintain or improve human wellbeing. However, the specific focus of each literature is somewhat different. Consequently, attempts to integrate the three have been quite limited. This study completes the third leg of policy research into sustainable development, population health and risk management by a small group of researchers at CPRN. These three approaches have been at the forefront of government policy development for the last number of years. At least one of the ways forward from this work is a partnership among Sholom Glouberman, CPRN and SMARTRISK to consider the interaction between these three big picture ideas. We are in the process of preparing a grant proposal to address these connections in greater detail than possible in the current report.

## **How the Research Was Done**

The research plan included three iterations of a process of

- literature reviews of material identified and suggested by SMARTRISK,
- interviews with experts in the fields of risk management, safety and injury prevention
- meetings with groups to test the frameworks and ideas as they emerged.

The project was initiated after meetings with Robert Conn and John Lewko to identify the main objectives of the think piece, the areas of concern of SMARTRISK and possible future collaboration between SMARTRISK and CPRN. The first iteration of the work occurred from April 2000 to January 2001.

A survey of the literature produced an annotated bibliography of major works in the three field prepared with the assistance of Jacob Schiff. John Lewko and SMARTRISK contributed an overview, summaries and initial bibliographies of risk and injury prevention literature to this effort. This provided the direction and initial impetus to the effort.

John Lewko and others identified a series of experts to be interviewed. The list was supplemented from the literature, and tested and amended using the responses of initial

interviewees. Interviews occurred in early 2001. They were summarized in an interview report and contributed substantial new information to the first draft of the report.

A brainstorming session was held in Ottawa on January 17 2001. It tested initial versions of the framework for comprehensiveness of scope and accuracy in describing the SMARTRISK domain. The meeting was lively and its participants brought healthy critical additions to the work so far. New research literature was introduced, and new experts were identified for interviews and revisions to the framework were suggested.

The second iteration began in late January. It was a much more rapid and intensive process than the first. Additions were made to the literature review, more interviews were held, the framework was substantially revised and a meeting was arranged with the SMARTRISK board committee on February 13.

At that meeting the second version of the framework and a first outline of the report were subject to intense discussion. A particular result of that meeting was the declaration of four major characteristics of the SMARTRISK approach, that:

1. It recognizes and makes use of the balance between measurable risks and people and organizations perception of risk.
2. Its domain considers risk at the level of individuals, organizations and society as a whole
3. It recognizes that although injury is in principle preventable, there will always be some level of injury and death through injury.
4. It applies the concept of a “stupid line” that divides acceptable and appropriate risk taking from risk taking that is unnecessarily dangerous to individuals as well as organizations (and perhaps to society as a whole)

The third iteration began after review of the first draft of this paper. Small meetings were conducted with several experts and finally a larger, expert panel meeting, to review the second draft of the report, was undertaken March 22, 2001. With the inclusion of further revisions from that meeting, this final draft was sent for peer review and amended into this final report.



## Chapter 1: The Boundaries of the Research Domains

SMARTRISK draws upon three different domains of research and intervention: Risk Management, Safety and Injury Prevention. As a starting point for this project it was originally thought that a comparison and contrast of the fields of safety, risk management and injury prevention would be most beneficial. As time and our understanding of these fields progressed it became apparent that the boundaries between these three domains were overlapping, and quite fluid. Further, on numerous occasions we were told that the boundaries were more conventions, tied to the preservation and marking of terrain in the public's mind and pocketbooks, of various organizations with specific commitments to their own survival as well as to the subject matter at hand. Nonetheless, some traditional distinctions can be drawn.

**Figure 1 The Research Domains which SMARTRISK Draws Upon**



### ***Safety Deals with Preventable Loss***

Safety organizations have traditionally been concerned with the prevention of loss. In fact, ***Loss Control*** is the name for a classic perspective from the organizational health and safety field.<sup>1</sup> The majority of professional bodies within the domain of safety are involved in one or more of what are known as the 3 Es of safety: education, enforcement and engineering.<sup>2</sup> For one example, the Canada Safety Council (CSC) is a public, workplace and traffic safety organization dedicated to prevention through education and public awareness. For another, the Canadian Standards Association (CSA) is a non-government, non-profit association that operates internationally to set standards for products and services through tests, certification, and inspection for safety and quality of performance. Similar concerns are addressed in the United States under the aegis of the Occupational Safety and Health Act, as well as the American National Standard Institute.<sup>3</sup> The concern of these organizations is the prevention of "accidents" [sic] frequently, though not always from a desire to prevent human injury. It should be noted that the use of the term "accident" in the safety literature is usually accompanied by a

context making it clear that it is preventability rather than chance that is the most important component of the concept.<sup>4</sup>

Safety as a field has broader concerns than health, however. The intent of safety is the prevention of loss, not only in human terms but also in terms of damage to property. For example, Emergency Preparedness Canada is a civilian branch of the Department of National Defense that states that its mandate is, "to safeguard lives and reduce damage to property by fostering better preparedness for emergencies in Canada."<sup>5</sup> Further a representative of the Canada Safety Council told us that their organization is as likely to be allied with enforcement agencies such as the office of the Solicitor General as with the health sector.<sup>6</sup> Indeed there have been past conflicts between representatives of Health Canada wishing to deal with issues such as drunk driving as purely health issues, while the CSC wishes to adopt a broader safety perspective.<sup>7</sup>

Thus the domain of safety has a mandate to prevent loss, whether such loss is measured in terms of human health or not. Additionally, through contacts with such other domains as criminal justice and enforcement of regulations and standards, the domain of safety even encompasses some aspects of prevention of losses that are not unintentional. In fact, it has been suggested that this field, once one considers all the potential workers in it, from manufacturers and installers of safety equipment, through inspectors, underwriters and analysts, to name but a few, should probably be considered the largest industry in the world.<sup>8</sup> The domain of safety thus encompasses the Preventable.

#### *Preventable versus Non-Preventable*

There is a very real question as to whether or not any injury isn't strictly preventable. It may be that all or virtually all injuries are preventable in principle. While the theories of quantum mechanics tell us that there are certainly events that are strictly probabilistic, they are far from the norm, and mostly encountered at the subatomic scale. The question thus isn't what is preventable in principle, but rather what we can reasonably prevent.

A case study will hopefully make this issue somewhat clearer. On July 25, 2000 a Concorde jet leaving the runway at Paris caught fire in what was to become one of the most publicized air disasters of recent memory. Despite the overall safety record of the air traffic industry in general, and of the Concorde in particular, this disaster launched a wave of public concern about air travel and safety. While the investigation into the causes of this event is ongoing,<sup>9</sup> the prevalent theory at the time of the writing of this report was that a small piece (40cm) of metal on the runway slashed the tire of the interior left front wheel, causing a blowout, and the expelling of flaming debris up into the fuselage of the aircraft.<sup>10</sup> Each of these events was independently of extremely low probability; thus the disaster seems to have been the result of a chain of flukes.

When asking whether this disaster could have been prevented the answer is, of course, yes. Runways could be inspected for debris between every take-off and landing, which if done, would likely have prevented this particular incident. Of course it would be impossible to perform such inspections and still maintain anything like our current rate of traffic flow at the airport. Such surveillance would be costly in terms of time, effort (both human and mechanical), and money. It is also worth noting that such surveillance would not have prevented any of the airline disasters where runway debris was not a contributing factor. Thus the question of whether this event was preventable, really turns on two issues, could we have anticipated the presence and impact of a 40cm piece of metal on the runway, and would we be willing to invest the resources necessary to find

and remove that and other pieces of debris. Nonetheless, despite the fact that such a chain of chance events may not be predictable or preventable in practice, we obviously can still learn from it. Since this event, for example, there has been discussion of possible designs for stronger fuel tanks.

What is preventable, then, turns out to be a region bounded by a line we've drawn. The parameters of that boundary, are our ability to foresee a particular hazard, and the resources that would be necessary to mitigate the impact of that hazard. Within the current aviation safety field, the Concorde disaster, once all the data is analyzed, may well prove to be beyond that line and thus not preventable in practice.

Acknowledging that not all injuries may be preventable given the constraints imposed should not be seen as fatalistic acceptance of the inevitability of "accidents".

SMARTRISK must maintain its focus on preventing every injury they can, nonetheless it would be as irrational to assume that eventually all injuries can be eliminated as to assume that nothing can be done to improve the status quo.

### ***Risk Management Deals with Unintended Outcomes***

Risk has become one of the great "buzzwords" of the late 20<sup>th</sup> and early 21<sup>st</sup> centuries.

Beck argues convincingly that post-modern society has moved from the wealth distribution concerns of the former society of scarcity, to concerns of *risk distribution*.<sup>11</sup>

Thus the concept of risk is central to many debates in modern society. Leiss and Chociolko call it "one of the most powerful concepts in modern society,"<sup>12</sup> precisely because it is both intuitively understood by the public, and simultaneously susceptible to rigorous formalization. Having said that, it must also be recognized that there are skeptics who view the 20<sup>th</sup> century's increasing focus on risk as a preoccupation, that is at best misleading and at worst a cynical tool of manipulation and control through fear-mongering.<sup>13</sup>

According to formal Decision Theory there is a distinction to be drawn between decisions made under certainty and decisions under uncertainty. Further decisions under uncertainty can be broken down into decisions made under uncertainty (simpliciter) where the decision maker has no way to evaluate the likelihood of the possible states of the world affecting the outcome of their decision, and decisions made under risk, where probabilities can be assigned to those states of the world.<sup>14</sup> Thus decision making under risk, means making decisions when you have some foreknowledge of possible outcomes but not perfect knowledge (See Table 1). This is not meant to suggest that one's foreknowledge is complete, or even particularly good. Often one has scant previous experience within a domain on which to base these estimates of probabilities, and thus there is a certain fuzziness to the boundary between these two examples of decision under uncertainty. Finally, modern conceptions of complexity raise the question of whether one can ever claim to have sufficiently good foreknowledge. As noted economist Kenneth Arrow has pointed out, one is unlikely to ever have the information one needs when one needs it.<sup>15</sup>

**Table 1 Three Types of Decision Based Upon Level of Knowledge  
Knowledge of States of the World**

Complete	Incomplete	
	Able to Assign Probabilities	Not Able to Assign Probabilities
Decisions Under Certainty	Decisions Under Risk	Decisions Under Uncertainty

Under the model described in Table 1, risk has no particularly negative connotations; rather it is an acknowledgement that one's information is probabilistic at best. For this reason, many writers, particularly those writing about environmental risks and disaster prevention prefer the term *hazard* to risk, as it captures both the probabilistic formalization and the negative connotations of risk in public discourse. However, rational decision-makers typically wish to optimize the outcome from their perspective, making choices that have the highest probability of a good outcome, or at least the lowest probability of a bad one. Thus even for the more mathematically inclined, risk frequently takes on its more common usage, something to be avoided.

Risk Management is the field of decision making that concerns itself with making choices that reduce unintended outcomes, while hopefully maximizing benefit to the decision-maker. The field of Risk Management is thus largely concerned with the unintentional.

*Unintentional versus Intentional*

On the subject of what is unintentional versus what is intentional it should be noted that many researchers in the tradition of Injury Prevention and Control consider this to be a moot point. There is also certainly no shortage of literature in either the traditions of social work or criminology/penology on the prevention of intentional injury. Nonetheless, the primary focus of the SMARTRISK foundation has traditionally been on injuries that were unintentional.

There are some gray areas at the boundary between the domains of the intentional and the unintentional. An example will help illustrate this distinction.

On November 16, 2000, Nathan Hall, a young skier from California was convicted of criminally negligent homicide in the death of Alan Cobb. On April 20, 1997 Hall had collided with Cobb on the slopes in Vail, Colorado after witnesses testified he had been skiing too fast under poor environmental conditions. Cobb died as a result of his injuries. Hall was originally charged with reckless manslaughter but convicted of the lesser, included charge of criminally negligent homicide.<sup>16</sup> Under both charges it is acknowledged that it was not Hall's intention to kill anyone, but rather that he had behaved recklessly, not taking into account the prevailing conditions, and should have been able to foresee the potential to cause harm.

It must be pointed out that the legal definitions of personal responsibility are not what are at issue, rather it is whether the actions of one agent significantly increased the risk of another agent sustaining an injury, but did not make it a planned consequence.

Preventing incidents such as the collision on that day in Vail are precisely within SMARTRISK's domain of interest. While the actions of another were directly responsible for the injury that took place, the injury itself was still unintentional. A similar argument can be made concerning other boundary cases such as injuries resulting from impaired driving, or from participation in a contact sport.

### ***Injury Prevention Deals with the Prevention and Control of Injury***

There have been initiatives in recent years in both the United States and Canada to create federal bodies responsible for injury prevention. For one example, there was the task force mandated creation of a Secretariat for Injury Prevention within Health Canada.<sup>17</sup> For another example, a division of the Centers for Disease Control in the U.S. is the National Center for Injury Prevention and Control (NCIPC). According to their web site the NCIPC, "works to reduce morbidity, disability, mortality, and costs associated with injuries."<sup>18</sup> The focus of this and other organizations is upon all sorts of injuries, whether unintentional or the result of violence, including self-directed violence and suicide. The NCIPC has fact sheets available on a range of topics that help illustrate the breadth of injury prevention's concern.

**Table 2 A Selection of NCIPC Fact Sheets**

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Adolescent Injury
American Indian/Alaska Natives and Intimate Partner Violence
Bicycle-Related Head Injuries
Child Passenger Safety
Childhood Injury
The Co-occurrence of Intimate Partner Violence Against Mothers and Abuse of Children
Dating Violence
Drowning: Injury Prevention
Falls and Hip Fractures Among Older Adults
Falls in Nursing Homes
Cost of Fall Injuries Among Older Adults
Firearm Injuries and Fatalities
Fireworks Injury Prevention
Impaired Driving
Intimate Partner Violence
Male Batterers
Motor Vehicle Deaths in Older Americans
Pedestrian Deaths and Injuries
Playground Injuries
Poisoning
Rape
Sexual Violence Against People with Disabilities
Suicide in the United States
Teenage Motor Vehicle Deaths
What You Can Do to Prevent a Fire
Youth Violence in the United States
Violence Among Youth and Violence in Schools

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The injury prevention tradition thus focuses on the prevention of injuries due to unsafe workplaces, and play, but also on topics such as the prevention of domestic violence, the fostering of safe communities, and the prevention of adolescent suicide. Additionally, the injury prevention tradition attempts to attenuate the impact of injuries that have occurred through a focus on acute care, and advocacy for proper long-term care and rehabilitation. Thus injury prevention is a tradition that concerns itself with the realm of injury.

#### ***Injury versus Infectious Disease***

Injury and infectious disease have much in common. In fact, in the medical parlance of the United Kingdom, both are referred to as species of illness. Further, many of the

experts we interviewed in the course of this project found the analogy between injury and disease quite productive. José Blanco, for example, speaks of entraining an organization to reduce injury-causing incidents, as equivalent to entraining the body's immune system to ward off infection.<sup>19</sup> Regular periods of stepped-up policing of particular traffic violations have been likened to providing booster shots of vaccines to children. Even the attempts to bring an epidemiological perspective to the fields of safety and injury prevention made use of many of the same terms, such as determinants, to describe injuries as diseases.

However, there are important distinctions to be drawn. William Haddon Jr. attempted to provide a clear and distinct definition of injury as any insult to the body arising from one of two causes: an interference with the body's energy exchanges or the delivery to the body of energy exceeding its threshold for damage.<sup>20</sup> While such a neat definition may seem appealing it is far too broad in scope. Under the first cause, one could easily situate strokes or for that matter kidney stones. This isn't a weakness for Haddon who considers the usage "vascular accidents" entirely appropriate. The second of Haddon's causes seems more like a restatement of the problem than a solution. It is likely that any other rigorous definition of injury will either omit events that SMARTRISK would naturally consider injuries of interest to them, or permit harmful events that might be more naturally classified as diseases.

Some features, however do seem to be present in most examples that readily come to mind when one thinks of injuries. By examining these, a certain "family resemblance" may emerge which will help us to distinguish most (if not all) cases of injury from disease. First there is the notion that most have an external cause, and that the cause of an injury, unlike an infectious disease, is not a germ. Second, there is the fact that most injuries are the result of a single traumatic event, while infectious diseases often result from repeated exposure to pathogens and have extended time courses for onset of ill health (incubation). Third, there is the observation that many injuries result from the application of force to the body. While there are certainly still problematic cases, such as repetitive stress injuries, which seem to be without some or all of these three features, the majority of the cases that fall within the domain of injury prevention will likely exhibit most or all of them.

### **What Else is Bounded by these Distinctions?**

Obviously, there are many domains bounded in some way by the notions of the unintentional, the preventable, and injury. For example, there are those events that are preventable injuries but which are intentional, such as incidents of domestic violence. Similarly there are unintentional injuries that are not preventable, such as random lightning strikes from a clear sky. There are also unintentional preventable events that do not result in injury such as exposure to HIV through sharing of needles.

There are also events that are contained within a single circle in this framework. One can strive to prevent events that are neither unintentional, nor resulting in injury such as white-collar crimes. One could be interested in unintentional consequences that are neither preventable nor resulting in injury, such as stock market fluctuations. Or, one could be interested in the domain of intentional, but not preventable injury, such as the archetypal "random acts of violence."

Finally, there are simply events that lie beyond all the boundaries in our model, and thus are intentional, not preventable, and not injurious, such as taxes.

## Notes

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<sup>1</sup> John Lewko, Workshop Participant, January 17 2001.

<sup>2</sup> Ethel Archard, Interview, January 24 2001.

<sup>3</sup> H.R. and C.A. Wentz Kavianian, Jr., *Occupational and Environmental Safety Engineering and Management* (New York: Van Nostrand Reinhold, 1990).

<sup>4</sup> Alton L. Thygerson, *Safety: Principles, Instruction, and Readings* (Englewood Cliffs, N.J.: Prentice-Hall Inc., 1972).

<sup>5</sup> Emergency Preparedness Canada, *Home Page* (2001 [cited February 9 2001]); available from <http://www.epc-pcc.gc.ca/home/>.

<sup>6</sup> Ibid

<sup>7</sup> Ibid

<sup>8</sup> John Adams, *Risk* (London: UCL Press Limited, 1995).

<sup>9</sup> Associated Press, *Tire Experts to Probe Concorde Crash Cause* [Internet] (CNN.com, 2000 [cited February 5 2001]).

<sup>10</sup> CNN, *Debris on Runway Raises New Questions About Concorde Crash* [Internet] (CNN.com, 2000 [cited February 6 2001]).

<sup>11</sup> Ulrich Beck, *Risk Society: Towards a New Modernity* (London: Sage Publications, 1992).

<sup>12</sup> William Leiss and Christina Chociolko, *Risk and Responsibility* (Montreal & Kingston: McGill-Queen's University Press, 1994) 3.

<sup>13</sup> Linda-Jo Schierow, "The Role of Risk Analysis and Risk Management in Environmental Protection," (Washington, DC: The National Council for Science and the Environment, 2000).

<sup>14</sup> Anatol Rapoport, *Decision Theory and Decision Behaviour*, 2 ed. (London: Macmillan Press, 1998).

<sup>15</sup> Ibid.

<sup>16</sup> Associated Press, *Skier Found Guilty of Homicide* [Internet] (2000 [cited February 5 2001]).

J. Martinez, *Skier Convicted in Accidental Death* [Internet] (2000 [cited February 7 2001]).

<sup>17</sup> Francine Archambault, Interview, November 23 2000.

<sup>18</sup> National Centre for Injury Prevention and Control, *Home Page* (Centres for Disease Control, 2001 [cited February 9 2001]); available from <http://www.cdc.gov/ncipc/ncipchm.htm>.

<sup>19</sup> José Blanco, Interview 2000.

<sup>20</sup> William Haddon, Jr., "A Note Concerning Accident Theory and Research with Special Referene to Motor Vehicle Accidents," *Annals of the New York Academy of Sciences* 107 (1963).

## Chapter 2: The Map of the Domain of Injury

### Two Organizing Frameworks for Injury

#### *The ICD-9cm E Codes*

One way of mapping the domain would be to use the classification scheme for injury in common clinical use--indeed such an approach was adopted in the epidemiological papers *The Economic Burden of Unintentional Injury in Canada*<sup>21</sup> and *The Economic Burden of Unintentional Injury in Ontario*<sup>22</sup>. In standard chart notation, all injuries are assigned a three-digit number from the E-Codes supplemental chapter of the International Classification of Diseases, where E stands for External Causes. A fourth digit is provided in order to further specify the injury, for example E810, is any accident involving a motor vehicle colliding with a train, E810.0 is such an accident that results in injury to the driver. The purpose of these codes is "to permit the classification of environmental events, circumstances, and conditions as the cause of injury, poisoning, and other adverse effects."<sup>23</sup>

An abbreviated summary of these codes is provided below in Table 3.

**Table 3 E-Codes from ICD-9-cm<sup>24</sup>**

Code Range	Cause of Injury	Example Code
<b>E800-E848</b>	<b>Transport Accidents</b>	
	e.g. motor vehicles	E810-825
<b>E849</b>	<b>Place of Accident</b>	
	e.g. home	E849.0
<b>E850-859</b>	<b>Accidental Poisoning by Drugs, Medicinal Substances and Biologicals</b>	
	e.g. Accidental Poisoning by Tranquilizers	E853
<b>E860-869</b>	<b>Accidental Poisoning by other Solid and Liquid Substances, Gases, and Vapours</b>	
	e.g. Motor vehicle exhaust gas	E868.2
<b>E870-876</b>	<b>Misadventure to Patients during Surgical and Medical Care</b>	
	e.g. Foreign object left in body during procedure	E871
<b>E878-879</b>	<b>Surgical and Medical Procedures as the Cause of Abnormal Reaction of Patient or Later Complication, without Mention of Misadventure at the Time of Procedure</b>	
	e.g. Shock Therapy	E879.2
<b>E880-888</b>	<b>Accidental Falls</b>	
	e.g. Fall from ladder	E881.1
<b>E890-899</b>	<b>Accidents caused by Fire and Flames</b>	
	e.g. Conflagration in private dwelling	E890
<b>E900-909</b>	<b>Accidents due to Natural and Environmental Factors</b>	
	e.g. Lightning	E907
<b>E910-915</b>	<b>Accidents Caused by Submersion, Suffocation, and Foreign Bodies</b>	
	e.g. Accidental drowning and submersion	E910
<b>E916-928</b>	<b>Other Accidents</b>	
	e.g. Struck accidentally by falling object	E916
	e.g. Striking against or struck accidentally by objects or persons, in sports	E917.0
	e.g. Accidents caused by machinery	E919
	e.g. Accident caused by electric current	E925
	e.g. Exposure to radiation, lasers	E926.4
<b>E929</b>	<b>Late Effects of Accidental Injury</b>	
	e.g. Late effects of accidental fall	E929.3



<b>E930-949</b>	<b>Drugs, Medicinal and Biological Substances causing Adverse Effects in Therapeutic Use</b>	e.g. Penicillins	E930.0
<b>E950-959</b>	<b>Suicide and Self-Inflicted Injury</b>	e.g. Hanging	E953
<b>E960-969</b>	<b>Homicide and Injury Purposely Inflicted by Other Persons</b>	e.g. Rape	E960.3
<b>E970-978</b>	<b>Legal Intervention</b>	e.g. Injury due to legal intervention by firearms	E970
<b>E980-989</b>	<b>Injury Undetermined Whether Accidentally or purposely inflicted</b>	e.g. Falling from high place, undetermined whether accidentally or purposely inflicted	E987
<b>E990-999</b>	<b>Injury Resulting from Operations of War</b>	e.g. Other and unspecified fragments (e.g. landmines)	E991.9

As can be seen these codes cover a wide range of potential causes of injury. Indeed a great many of them lie outside the boundaries of SMARTRISK's traditional interests (e.g. E990-999 Injury Resulting from Operations of War). That is one reason that they provide an unsuitable framework for mapping the domain of injury for our purposes. Another, more serious objection is the nature of the causes listed. All of these causes are, by definition, external to the individual and singular in operation. Roughly speaking, they all correspond to the Agent column in the Haddon matrix (Figure 2). All focus purely on outcomes for the biological organism. There is no potential for discussion of the contribution of the individual to the injury-causing event, much less the complex interaction of that individual with, for example, their social environment. Accordingly, we will attempt to develop our own framework for discussing preventable injuries, turning first to another classification scheme.

### *The Epidemiological Tradition*

In the early 1960s, Dr. William Haddon Jr. attempted to provide a taxonomy of injury events.<sup>25</sup> He presented a spatio-temporal matrix for an injury, divided along two dimensions. The first of these was the participants in the injury: the Host, the Agent and the Environment. The second dimension was the time course of the injury: pre-injury, injury and post-injury. This framework has been reproduced below as Figure 2.

**Figure 2 The Haddon Matrix<sup>26</sup>**

	<b>Host</b>	<b>Agent</b>	<b>Environment</b>
<b>Pre-injury</b>			
<b>Injury</b>			
<b>Post-injury</b>			

Within each of the cells of this matrix are clustered the various variables, whose values can be said to either increase or decrease the likelihood of injury. For example, the framework was originally developed with traffic safety in mind, and thus the host would be the driver, the agent the automobile, and the environment the road and weather conditions. Within the cells would be such variables as the presence of alcohol in the driver's bloodstream at the intersection of Host and Pre-Injury, and the presence of another driver skidding on an ice patch at the intersection of Environment and Injury. While this framework is often cited as the dawn of the injury prevention tradition, or at least the start of the introduction of social scientific methods into the safety tradition<sup>27</sup>, it

will not suffice for our map of the domain of injury. First, in focusing on only spatial and temporal dimensions of injury events, the framework tends to ignore the psychological, socio-cultural, etc. potential determinants of injury. While this matrix could be stretched to accommodate these, it certainly goes beyond the initial concept. Perhaps more important, however, is the fact that the factors in the above matrix are all discrete and static. It does not permit one to easily deal with interactions between factors, such as a driver becoming particularly angry (a state of the Host) in the face of repeated tailgating by another driver (a state of the Environment).

## **A Tentative Framework**

### ***Three Perspectives on Health***

Despite widespread interest in health issues and in the development of health policy in recent years there has been relatively little written on the concept of health within the past 30 years. As part of the *Towards a New Perspective on Health Policy* project, the Health Network of Canadian Policy Research Networks conducted a survey of developments in the concept of health from ancient times to the present.<sup>28</sup> It was found that ideas about health and illness tended to cluster into three perspectives. The first of these focussed on health as a function of the individual organism. The second focused on health as a product of environmental determinants, considering each of the natural, built and especially the social environments. Additionally, a third tradition has been emerging that views health and illness as the product of the nature of the interaction between an individual and their environments.

#### *The Individual*

The medical tradition has for a long time focused on the individual. Major advances in medical knowledge have resulted from an ever-deepening understanding of the physiology and psychology of the individual person. The Human Genome Project is perhaps the ultimate development in this line of research. Within the clinical, medical tradition, interventions on the individual body seek to maintain health and prevent or cure illness.

#### *The Environment (Natural, Built and Social)*

Thomas McKeown's ideas are a good example of a second tradition, which looks beyond the body. He argues that medical intervention is a lesser contributor to the health of an individual than the environment. This emphasis on environmental factors is a strong part of the public health tradition, which begins with the Sanitarian movements and can be traced through ideas of health promotion and current work on the inequalities in health. Increasingly this tradition emphasizes the social and economic environment as having the greatest influence on health.

#### *The Interaction Between Them*

A third view of health, which focuses on interactions between individuals and their environment, has begun to be articulated in the last century. Talcott Parson's work, in a sociological tradition beginning with Durkheim on the boundary between health and illness relates people's capacities to engage in their social and work environment to their health status.<sup>29</sup> His ideas help us to understand health in terms of the interplay between an individual and his or her social context. Antonovsky's discussion of the nature of

resiliency of holocaust survivors identifies the capacity to use the resources one has to respond to misfortune as a major contributor to health.<sup>30</sup>

***How These Perspectives Relate to Preventable Injury***

It is hoped that this framework will aid in sorting through the research on unintentional injury, and also provide fresh perspectives for the development of policies and interventions. Accordingly, in the next three chapters we will examine data relevant to SMARTRISK from the literatures on risk management, safety, and injury prevention pertaining to individuals, environments and the interactions between them respectively. It should be noted that SMARTRISK is not only interested in the decision-making behaviour of individual humans, but also in decisions made by organizations. Thus the notion of the individual is expanded from that above, the single physical body, to any single agent that makes decisions under risk, whether that agent is an individual human being, or a corporate entity such as a particular manufacturing company. The present analysis then, takes the form of a matrix, which has rows labeled Risk Management, Safety and Injury Prevention, and columns labeled Individuals, Environments and the Interactions between them. Some examples of this analysis are presented below in Table 4.

**Table 4 Applying our Framework to the Research**

	<b>Individuals (including organizations)</b>	<b>Environments (Natural, Built and Social)</b>	<b>Interactions</b>
<b>Risk Management</b>	Risk Perception Decision Making	Organizational Risk Management Cultural Dimensions	Risk Communication Risk Homeostasis
<b>Safety</b>	Education	Engineering	Enforcement
<b>Injury Prevention</b>	Consequences Strategies	Consequences Strategies	Consequences Strategies

**Notes**

<sup>21</sup> The Hygeia Group, "The Economic Burden of Unintentional Injury in Canada," (Toronto: SMARTRISK, 1998).  
<sup>22</sup> The Hygeia Group, "The Economic Burden of Unintentional Injury in Ontario," (Toronto: SMARTRISK, 1999).  
<sup>23</sup> "Supplementary Classification of External Causes of Injury and Poisoning (E800-E999)," in *International Classification of Diseases, 9th Revision, Clinical Modification, Colour Coded*, ed. Melanie C. Karaffa (Los Angeles: Practice Management Information Corporation, 1993).  
<sup>24</sup> Ibid  
<sup>25</sup> Haddon, "A Note Concerning Accident Theory and Research with Special Referene to Motor Vehicle Accidents,".  
<sup>26</sup> Adapted from Appendix B of The Hygeia Group, "The Economic Burden of Unintentional Injury in Canada," , 70.  
<sup>27</sup> Herb Simpson, Interview, December 19 2000.  
<sup>28</sup> Sari Kisilevsky, Philip Groff, and Catherine Nicholson, "The Health Gradient Challenge: A New Approach to Health Inequalities," in *Towards a New Concept of Health: Three Discussion Papers*, ed. Sholom Glouberman (Ottawa: Canadian Policy Research Networks, 2000).  
<sup>29</sup> Talcott Parsons, "Illness and the Role of the Physician: A Sociological Perspective," *American Journal of Orthopsychiatry* 21 (1951).  
<sup>30</sup> Aaron Antonovsky, *Health, Stress, and Coping*, 1st ed. (San Fransisco, CA: Jossey-Bass Publishers, 1979).

## Chapter 3: The Individual

### Risk Management and the Individual

#### *How Individuals Get Information about Risks: Risk Perception*

One of the remarkable developments in recent years has been the tremendous growth of the field of Risk Perception. This field of research was initially predicated upon the assumption that there is a divide between the objective risks associated with particular hazards, technologies, etc. and the estimation of those risks by the general public. It should be noted that in general the field no longer embraces this notion of "objective risk" and that instead the distinction is drawn between the assessment of risks by experts and by novices, while recognizing the role of subjective processes in both types of assessment.<sup>31</sup>

The field of Risk Perception has become divided into a number of research traditions from the quite empirically grounded tradition modeled on psychometric studies of sensory perception, to the more sociologically and anthropologically oriented traditions of culture theory and social amplification of risk. Of these, the field that lies at the intersection of Risk Management and the Individual is the psychometric tradition, and thus it is to this tradition we now turn.

The so-called psychometric studies of risk have focused on attributes of hazards that might increase or decrease the level of risk the individual perceives. For example, one study of the perceived risk in the nuclear power industry in the Netherlands found the following list of attributes that influence risk perception.

**Table 5 Negative Attributes that Influence Risk Perception<sup>32</sup>**

- 
1. Involuntary exposure to a risk.
  2. Lack of personal control over outcomes.
  3. Uncertainty about probabilities or consequences of exposure.
  4. Lack of personal experience with risk (fear of the unknown).
  5. Difficulty in imagining risk exposure.
  6. Effects of exposure delayed in time.
  7. Genetic effects of exposure (threat is to future generations).
  8. Infrequent but catastrophic accidents.
  9. Benefits not highly visible.
  10. Benefits go to others (inequity).
  11. Accidents caused by human failure rather than natural causes.
- 

As can be seen from the above table, people are more likely to rate a hazard as of higher risk for a number of reasons. The entries in the table, however do seem to cluster around a number of issues, namely the uncertainty felt by the public about the hazard, the potential for extreme outcomes, and lack of perceived control over exposure to or mitigation of the risk.

More sophisticated psychometric studies have been conducted for a number of years by the Decision Research Group in Oregon.<sup>33</sup> These studies have typically asked subjects to rate various natural and technological hazards relative to each other. These ratings are then subject to factor analytic techniques in an attempt to uncover underlying dimensions of risk perception.

In one such classic study the degree of perceived risk was found to relate to three factors. The first of these was the degree of dread associated with the hazard, with nuclear

weapons being at the high end of this scale, and household appliances at the low end. The second factor was how well known the hazard was, with items like handguns and motor vehicles at the well-known end of this continuum and items like DNA research and solar-electric power at the unknown end. Finally, a weak third dimension seemed to be related to the scope of the hazard in terms of how many people would potentially be affected.<sup>34</sup>

Similar results have been reported in follow up studies using similar methodologies<sup>35</sup> including studies on particular populations such as adolescents.<sup>36</sup> However there have also been harsh criticisms of both the use of rating scales to collect this sort of data, restricting the sorts of comments subjects can make, and also of the factor analytic technique which collapses across individual responses, thus blurring any potential individual or group differences.<sup>37</sup>

Perhaps more important than the critique of particular methodologies is the question of the appropriateness of contrasting public judgments of risk with "expert" assessments, under the assumption that the latter is universally better than the former. As Leiss and Chociolko point out, there are several reasons to consider this assumption suspect: the level of disagreement often encountered among and between expert risk assessments, the chronic underassessment of certain classes of risks, and experimental findings showing the impact of such psychological factors as overconfidence on experts' judgements.<sup>38</sup>

Finally there is simply the critique that in true Heisenberg fashion, every attempt to measure risk objectively has the potential to alter the risk taking behaviour of individuals.<sup>39</sup> Indeed if it did not, there would be little motivation for such measurement to begin with. Nonetheless this does raise the question of whether or not any such thing as objective risk can be said to exist.

### ***How They Weigh This Information***

Within the risk management tradition and indeed within management traditions in general there has been considerable discussion about how evidence of risks is and ought to be weighed. Two general principles have arisen in much of the formal work on decisions made under risk by individuals.

The first of these is that there is a wide range of individual differences in the level of tolerance for risk. What one decision-maker might consider an unacceptably high probability of a negative outcome, is to another person perfectly acceptable, or even low. Economists have long discussed this basic dimension along which people differ, referring to some individuals as *risk prone* and others as *risk averse*. Experimental studies and formal models have found that this is not a simple unitary dimension, however. The same individual may appear risk prone or risk averse under different environmental circumstances, or when asked to evaluate a problem in terms of potential benefits, as opposed to potential losses.<sup>40</sup>

A second important principle is the difficulty people often have in evaluating probabilities subjectively. There is a long standing debate over what model of probability is used, or ought to be used, by individuals in evaluating risks, with at least three strong contenders: classic probability, frequency, and Bayesian or subjective probability.<sup>41</sup>

Ignoring such theoretical debates, there is also experimental evidence indicating that individuals frequently have difficulty in working with probabilistic data, for example the persistent finding, that subjects frequently overestimate objectively small probabilities, and underestimate objectively large ones.<sup>42</sup> In fact, there is a long standing research

program in the social sciences that suggests that individuals simply do not rationally process probabilistic data in any way--relying rather on heuristics such as **representativeness** (judgements based on how well a given individual or situation fits a preconceived stereotype) to make judgements.<sup>43</sup> Certainly some of the findings in the "psychophysical" tradition of risk perception discussed above would seem to be the product of such heuristics as **availability** (judgements based upon how readily an exemplar comes to mind).<sup>44</sup>

Third, there is the important consideration that not all risks are taken as a result of conscious deliberation. Very often risky behaviours are engaged in without any assessment of the probabilities involved.<sup>45</sup> Further, even when probabilities are assessed they are rarely cumulated properly over time. Thus the illusion persists that if one got away with some high-risk behaviour once, one will get away with it again.<sup>46</sup>

### ***How They Make Decisions Under Risk***

#### *Normative Theories*

The basic framework of normative Decision Theory states that decisions under risk are made by laying out one's alternative courses of action in a matrix against the potential states of the world, each with its associated estimate of probable occurrence (risk). One then fills the matrix with estimates of expected outcomes, usually the product of the value (utility) of that alternative given that state of the world, and the probability of that particular state obtaining. The probabilities used are based upon one's perception of risk, or receipt of suitable risk communication, or just from personal experience.

Once one has set up the decision problem in such a matrix (either explicitly or more often implicitly) the question remains how to decide from among the range of possible courses of action. Within the field of Decision Theory, dealing with decisions under uncertainty and risk, a number of formal *decision rules* have been proposed. The first of these is called **maximin**, which stands for "the maximum of the minima." Under this decision rule, one assumes the worst state of the world is the one most likely to obtain, and selects a course of action that produces the best of the worst case outcomes. This somewhat pessimistic rule is contrasted with a decision rule called **maximax**, which is essentially the opposite. Assume the best state will obtain and make your decision that will optimize your benefits if it does. A third decision rule called **Hurwicz' alpha** bridges the gap between these extremes. One sets alpha between zero and one at the level of one's tolerance for risk. At the extremes this decision rule simplifies to the **maximin** when alpha is set to 1, and **maximax** when alpha is set to zero. Finally, there is the decision rule called **insufficient reason** under which one remains agnostic about the relative likelihood of the possible states of the world, and makes one's choice based upon the average expected outcome for each. There have been many debates in the literature over the relative strengths and weaknesses of each of these rules.<sup>47</sup>

Strictly speaking each of the above rules was developed for making decisions under complete uncertainty, in other words without the ability to assign probabilities to the potential states of the world. In decisions under risk one's estimation of the probable outcomes can shape one's pessimism or optimism about how likely the worst and best outcomes are, and thus help suggest which of the above rules is more likely to be successful in the current situation.

In terms of corporate risk management procedures, a number of mathematical decision making frameworks have emerged including: *Cost-Effectiveness Analysis (CEA)*, *Risk-Benefit Analysis (RBA)*, *Benefit-Cost Analysis (BCA)*, and *Socio-Economic Impact Analysis (SEIA)*, to name just a few.<sup>48</sup> The first of these *CEA* begins with a clear target, for example a reduction of 50% in a particular class of injury, and analyses different means of achieving that goal in terms of costs, usually direct. In contrast, *RBA* has no preset goal, and instead the potential benefits and risks of each alternative course of action are compared across the board. Expected health costs are one of the implicit outcomes of such an analysis. Thus *RBA* is close to the individual decision theory models discussed above. Even closer is *BCA* where the expected costs to health, for example, are treated directly, rather than indirectly as in *RBA*, for example increases to the economic burden of particular health outcomes from the decision to be made are incorporated into other costs in the analysis. The disadvantage of *BCA* is that all costs must now be considered in a unified, monetary, scale of measurement. *SEIA* extends this strategy even further and tries to incorporate non-allocative effects of decisions, such as impact on trade conditions, inflation, regional impacts, etc. Each of these decision rules, both for corporations and individual agents, is predicated upon the ability to generate a mathematical model of the problem to be solved. This ability can in turn be broken down into three conditions that must be satisfied before such an approach can be attempted. Generally speaking, such methods are only useful if:

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**Table 6 Application of Mathematical Decision Theory to Decisions under Risk<sup>49</sup>**

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1. Probabilities of relevant states of nature can be estimated or calculated with sufficient confidence.
  2. Some observable quantity can be taken as a measure of utility.
  3. The risky situation is in principle repeatable.
- 

*Descriptive Theories*

The basic framework, set out above, raises the question of where the alternatives come from, to begin with, and how one specifies the range of possible states of the world. There is disagreement about the specifics of how one makes such judgements, but some points of agreement upon what requirements a completely rational agent might meet in doing so. See Table 7 for a sample list, called Vigilant Information Processing.<sup>50</sup>

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**Table 7 Requirements of Janis & Mann's (1977) Vigilant Information Processing<sup>51</sup>**

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1. A competent decision-maker examines a wide range of available alternative courses of action.
  2. He or she also examines as full a range as possible of the objectives to be realized or values to be served by each of the available courses of action.
  3. All actions have consequences, negative as well as positive. As many as possible of these consequences, both positive (benefits) and negative (costs) as well as the risks associated with the negative consequences should be weighed.
  4. The competent decision-maker is on the look out for new relevant information in the light of which the alternatives can be re-evaluated.
  5. Whenever new relevant information concerning the consequences or the likelihood of their occurrence can be obtained, the competent decision-maker seeks it. Most important, information that does not support the decision-maker's preferred course of action must be taken into account as attentively as information that supports it.
  6. Before making the final choice, the effective decision-maker re-examines the envisaged consequences of the alternative courses of action, including the courses of action that may have been initially discarded as unacceptable.
  7. Choosing a course of action does not mean that the decision problem has been solved, as may be inferred from the formulation of formal decision theory. To be effective, decisions must be implemented. Therefore making detailed provisions for implementing decisions to be taken must be part of the process of arriving at 'good decisions'.
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Of course such a list is said to be an idealization, with most decision making falling well short of these full criteria. According to Janis and Mann, the average decision-maker, whether an individual or an organizational body, is faced with a sequence of four questions. Answering affirmatively to all four in order, results in vigilant information processing, while answering negatively at each stage leaves the individual in a less vigilant state, when weighing alternatives. The sequence of questions, and the state arrived at by answering no to each are presented in Table 8.

**Table 8 Questions to be Answered Affirmatively to Reach Vigilance<sup>52</sup>**

<b>Sequence of Questions to Be Answered.</b>	<b>Consequences of answering no at each stage.</b>
1. Are the risks serious enough if I don't take protective action?	<b>Unconflicted Inertia</b>
2. Are the risks serious if I take the most readily available protective action?	<b>Unconflicted Change</b>
3. Is it realistic to try and find a better means of escape?	<b>Defensive Avoidance</b> --Tendency to satisfice rather than solve the problem.
4. Is there sufficient time to search and deliberate?	<b>Hypervigilance</b> --Tendency to keep searching for alternative courses of action, in a non-systematic or thorough way. Often results in panic.

### ***How They Live With Their Decisions***

Finally, as noted above, reaching a decision is not the end of the process. Once decisions are made they must be implemented, and then the decisions must be lived with. There has been a great deal of psychological research on the techniques employed by individuals to live with their decisions. For example, the literature on Conflict Decision Theory has generated the following list of strategies that are employed to bolster one's chosen course of action.

**Table 9 Bolstering Strategies<sup>53</sup>**

1. <i>Exaggerating favourable consequences</i> of the favoured course of action focusses attention on gains to be made.
2. <i>Minimizing the unfavourable consequence</i> is frequently associated with the (often self-induced) belief that if worst comes to worst, it will not be so bad.
3. <i>Bolstering the belief that the decision is reversible</i> is exemplified by the rationalization, "I can always stop if it's hurting me."
4. <i>Denying aversive feelings</i> anticipated in connection with unfavourable consequences. (For example believing that a job one isn't qualified to do will be challenging, not frustrating).
5. <i>Exaggerating the remoteness of the reckoning</i> is the principle feature of rationalizations of recklessness.
6. <i>Minimizing personal responsibility</i> .

It is worth noting that individuals and organizations do not employ the above strategies only after making a decision, but frequently in advance as well. Doing so results in short cutting many of the more elaborate decision procedures outlined above, in order to arrive at a preferred course of action.

### ***Lessons for SMARTRISK***

1. People perceive risks not on the basis of objective criteria, but often based on the dread that the hazard evokes, the familiarity of the hazard in their experience, and their sense of control over their exposure.
2. Even when people have access to hard estimates of risks they often don't weigh this information rationally, but rather heuristically. For just one example, people often



fail to understand that risks can accumulate across time--leading to a sort of "survivor's fallacy".

3. Some people are simply more risk prone in their decision making than others.
4. The formal theories of decision under risk assume some sort of weighting of potential benefits and potential costs by the estimated probabilities of expected outcomes.
5. In practice, decision making is more often expedient or heuristic, with inertia or reduction of panic as core values rather than rationality.
6. In this context, people and organizations are most likely to use risk data post-hoc to bolster their satisfaction with and confidence in the decisions they've made for other reasons.

## **Safety and the Individual**

The tools for change that have been traditionally employed in the safety field are conveniently labeled the three Es: education, engineering and enforcement. Any strategy to reduce unintentional injuries from the perspective of safety is likely to rely upon one or more of these tools. Accordingly, in this chapter, and in each of the next two, we will use the three Es as an organizing framework for discussing the safety tradition.

### ***Education is Primary Intervention***

When focussing on injury prevention at the level of the individual it would seem that the tool of choice is education. There is a long tradition of safety education directed at individuals from such homespun wisdom as "Look before you leap," and "Don't run with scissors," to social marketing slogans such as "If you Drink, Don't Drive." The usefulness of such individually targeted safety messages is debatable however. A growing body of literature has begun to examine the response of individuals to such messages. For example in the report *Preventing Unintentional Injuries Among Children* to the National Forum on Health, Morrongiello discusses some of the problems with assuming that communicating safety rules to children will reduce their incidence of unintentional injuries. One is tempted to believe that if only children were made aware of risks, through the provision of safety rules such as those mentioned above, they would in turn modify their behaviour. However, Morrongiello has found that children are quite aware of their parents' safety rules. The difficulty they have is in transferring the information from one domain to another, and in complying with them in the face of other competing pressures.<sup>54</sup>

Simply telling people about the risks they're facing is doomed to fail. This failure comes partly from failure to recognize the complexity of the individuals being communicated with, and the complexity of their interactions with their environment. As Morrongiello points out, "Individuals aren't just risk takers, rather they are balancing many needs at once."<sup>55</sup> Risks aren't only a matter of physical injury, but also of loss of face, social isolation, etc., which are less easily measurable.

### ***Engineering***

While education is the primary tool for change when dealing with individuals from the perspective of safety, there are also engineering approaches used here. The design of safer bicycle helmets or the additions of new safety features to automobiles, such as ABS brakes are examples of safety interventions targeted at individuals. While there is no

doubt that wearing appropriate safety gear, or driving a safer vehicle has the potential to improve personal safety it is interesting to note that often the reverse is found to be the case. In Chapter 5, we discuss some of the surprising results of quite sensibly targeted safety measures.

### ***Enforcement***

Finally, of course, one can attempt to improve the safety of the individual through the enforcement of regulations. For one example, consider mandatory seatbelt legislation in Canada.

“Death and injuries due to automobile accidents could probably be reduced by 50% if everyone wore seat-belts, *and* if stricter measures were taken to reduce the number of impaired drivers. In spite of this knowledge,” wrote Lalonde in 1974, “the rate of seat-belt wearing stays at about 10% and alcohol continues to be a factor in half the traffic accidents.”<sup>56</sup> Today, the vast majority of Canadians wouldn’t dream of getting behind the wheel without buckling up: close to 90 percent of Canadian drivers and passengers always wear seatbelts,<sup>57</sup> and the number of traffic fatalities has decreased by almost 45 percent since 1970, despite a doubling of both licensed drivers and cars on the road.<sup>58</sup> A big factor in this change is legislation: no province had mandatory seatbelt laws in 1971; by 1996, all provinces and territories had enacted such legislation.<sup>59</sup>

Of course there are those who would dispute the notion of a causal connection between seatbelt legislation and reduced traffic fatalities.<sup>60</sup> Nonetheless, it does seem worth noting that there have been attempts to improve safety at the individual level that have employed enforcement strategies, and that there is some reason to believe they have had some success.

### ***Lessons for SMARTRISK***

1. People are not just "risk takers" they make decisions balancing many different classes of needs. Education must consider the whole person, and their whole psychology, not just seek to impart information about "objective risks."
2. Engineering of better gear for individual safety is probably less important than successfully marketing that gear. Thus an interactive orientation is probably preferable to an individual one.
3. While adopting different orientations (individual, environment, interaction) seems to suggest a different emphasis on each of the Three Es of Safety, one must recognize the potential for benefits from unanticipated sources--for example the culture change around seatbelt use that resulted from a legislative intervention.

## **Injury Prevention and the Individual**

There is a great deal of overlap between the injury prevention literature and the literature in safety and risk management. Indeed it has been suggested that the literature on injury prevention is the health safety literature, seen from a risk management perspective.

However, there do seem to be two tendencies that set apart this third tradition. The first is a focus on the consequences of injury, and the second is a focus on strategies specifically to reduce injuries. These two trends are not independent; in fact the second is often strongly informed by the first.

## ***Consequences***

Social Marketing has a long tradition in the health promotion field. Social Marketing that focuses the individual on the potential negative consequences of their risk taking behaviour is also commonplace. For example, there are numerous antismoking campaigns that have made use of pictures of diseased lungs, in an effort to curb smoking behaviour among young people. Similar approaches have been taken in an effort to reduce injuries, such as arranging speaker's who've survived serious injuries to help concretize the potential consequences of high-risk behaviour.

Such social marketing can have unintended consequences, however. There is a body of research demonstrating reactance to messages that are perceived as "fear mongering." Indeed, there is evidence that in some cases the very highlighting of the potential for extremely negative outcomes serves to glamorize the initial high-risk behaviour even further.<sup>61</sup>

## ***Strategies to Reduce Injuries***

Aside from focussing on consequences, the other feature of the Injury Prevention tradition is the formulation of strategies with the reduction of injuries as the principle goal. We will use the example of reducing injuries due to falls in the elderly throughout this section of Chapters 3, 4 and 5 to illustrate how a particular set of injury can be tackled by interventions at the level of the individual, environment and interactions, respectively.

The case of falls in the elderly makes a good test case, with potential policy traction for a number of reasons--not least of which, is the seriousness of the problem in Canadian society. Injury-related falls are an issue which becomes ever more serious in the demographic context of an aging population.<sup>62</sup> Serious falls can be life shortening: 20% of elderly people who suffer a hip fracture die within a year.<sup>63</sup> But the risk of injury contributes much more broadly to increased dependency and disability.<sup>64</sup> The very fear of falling, can lead to decreased confidence in the ability to ambulate safely, feelings of helplessness, social isolation and may increase a person's risk for falls.<sup>65</sup> At the same time it is widely recognized that maintaining mobility is critical to quality of life.

At the level of the individual, numerous strategies have been attempted to reduce injuries in the elderly. These range from early attempts to restrict mobility through the use of restraints, to later attempts to increase individual mobility through exercise regimes. Additionally, there have been attempts to mitigate the injuries caused by falls, through the adoption of various forms of protective gear for fall-prone elderly persons. All have had some degree of success, but recent research suggests that targeting the individual may not be as useful a strategy in general, as working toward a safe, yet challenging, environment, and encouraging positive social interactions.<sup>66</sup> These approaches will be visited in Chapters 4 and 5 respectively.

## ***Lessons for SMARTRISK***

1. In social marketing of risk information there is the potential for a negative outcome, as fear mongering often glamorizes the activity in question.
2. Injury prevention initiatives targeted solely at individuals are often not as successful as those focussing on culture change, and environmental enrichment.

## Notes

- <sup>31</sup> Nick Pidgeon et al., "Risk Perception," in *Risk: Analysis, Perception and Management*, ed. Sir Francis Graham-Smith (London: The Royal Society, 1992).
- <sup>32</sup> Adapted from a study by Otway & von Winterfeldt (1982) as reproduced in Table 2. of *Ibid.*, 101.
- <sup>33</sup> Paul Slovic, "Perceptions of Risk: Reflections on the Psychometric Paradigm," in *Theories of Risk*, ed. S. Krimsky and D. Golding (New York: Praeger, 1992).
- <sup>34</sup> Paul Slovic, S. Lichtenstein, and Baruch Fischhoff, "Facts and Fears: Understanding Perceived Risk," in *Societal Risk Assessment: How Safe Is Safe Enough?*, ed. R.C. Schwing and W.A. Albers (New York: Plenum Press, 1980).
- <sup>35</sup> Slovic, "Perceptions of Risk: Reflections on the Psychometric Paradigm,".
- <sup>36</sup> Alida et al. Benthin, "A Psychometric Study of Adolescent Risk Perception," *Journal of Adolescence* 16 (1993).
- <sup>37</sup> Pidgeon et al., "Risk Perception,".
- <sup>38</sup> Leiss and Chociolko, *Risk and Responsibility*.
- <sup>39</sup> Adams, *Risk*.
- <sup>40</sup> M. et al. Cohen, "Individual Behaviour under Risk and under Uncertainty: An Experimental Study," *Theory and Decision* 18 (1985).
- <sup>41</sup> See any of Gerd Gigerenzer, *The Empire of Chance* (Cambridge: Cambridge University Press, 1989). Ian Hacking, *The Emergence of Probability* (Cambridge: Cambridge University Press, 1975). Ian Hacking, *The Taming of Chance* (Cambridge: Cambridge University Press, 1990). for a review of this debate.
- <sup>42</sup> See M.G. Preston and P. Baratta, "An Experimental Study of the Auction Value of an Uncertain Outcome," *American Journal of Psychology* 61 (1948). for a classic demonstration of this finding
- <sup>43</sup> D. Kahneman and A. Tversky, "Subjective Probability: A Judgement of Representativeness," *Cognitive Psychology* 3 (1972).
- <sup>44</sup> D. Kahneman, Paul Slovic, and A. Tversky, eds., *Judgement under Uncertainty: Heuristics and Biases* (Cambridge: Cambridge University Press, 1982).
- <sup>45</sup> Nick Pidgeon, Interview, February 27 2001.
- <sup>46</sup> John Lewko, Workshop Participant, January 17 2001. Pidgeon.
- <sup>47</sup> Rapoport, *Decision Theory and Decision Behaviour*.
- <sup>48</sup> This sample of risk management procedures, and their general descriptions are adapted from Leiss and Chociolko, *Risk and Responsibility* 40-41.
- <sup>49</sup> Rapoport, *Decision Theory and Decision Behaviour*.
- <sup>50</sup> I.L. and Mann Janis, L., *Decision Making* (New York: Free Press, 1977).
- <sup>51</sup> Rapoport, *Decision Theory and Decision Behaviour*.
- <sup>52</sup> Janis, *Decision Making*.
- Rapoport, *Decision Theory and Decision Behaviour*.
- <sup>53</sup> *Ibid.*
- <sup>54</sup> Barb Morrongiello, "Preventing Unintentional Injuries among Children," in *Determinants of Health: Vol.1 Children and Youth* (Ottawa: National Forum on Health, 1998).
- <sup>55</sup> Barb Morrongiello, Interview, January 24 2001.
- <sup>56</sup> Marc Lalonde, *A New Perspective on the Health of Canadians: A Working Document*, 1981 ed. (Ottawa: Minister of Supply and Services Canada, 1974) 24.
- <sup>57</sup> Transport Canada, *Seat Belt Use in Canada - June 1998 Survey Results: Table 1* [Internet] (Transport Canada, November 1998 1999 [cited March 5 1999]); available from <http://www.tc.gc.ca/roadsafety/stats/sbuse98/English/sb98ta1e.htm>.
- <sup>58</sup> Transport Canada, "Canadian Motor Vehicle Traffic Collision Statistics," (Ottawa: Transport Canada, 1979). Transport Canada, "Canadian Motor Vehicle Traffic Collision Statistics," (Ottawa: Transport Canada, 1997).
- <sup>59</sup> Hans Arora, "Seat Belt Usage Laws Enacted by Province, by Date," (Ottawa: Transport Canada, 1998).
- <sup>60</sup> J.G.U. Adams, *Risk and Freedom: The Record or Road Safety Regulation* (London: Transport Publishing Projects, 1985).

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Gerald J.S. Wilde, "On the Choice of Denominator in the Calculation of Accident Rates," in *Transport Risk Assessment*, ed. S. Yagar (Waterloo, ON: University of Waterloo Press, 1984).

<sup>61</sup> Gerald Wilde, Interview, January 24 2001.

<sup>62</sup> A. Brainsky et al., "The Economic Cost of Hip Fractures in Community-Dwelling Older Adults: A Prospective Study," *Journal of the American Geriatrics Society* 45 (1997).

<sup>63</sup> Rein Tideiksaar, *Falls in Older Persons, Prevention & Management*, 2nd ed. (Baltimore, MD: Health Professions Press, Inc., 1998).

<sup>64</sup> Joanna H. Downton, *Falls in the Elderly* (Philadelphia: Edward Arnold, 1993).

<sup>65</sup> J. Howland et al., "Fear of Falling among the Community-Dwelling Elderly," *Journal of Aging and Health* 5, no. 2 (1993).

<sup>66</sup> Pam Holliday, *Research into Balance and Falls: The Baycrest Experience* (Toronto: Baycrest Centre for Geriatric Care, 1995), Audiocassette.

Mark C. Hornbrook, "Preventing Falls among Community-Dwelling Older Persons: Results from a Randomized Trial," *Gerontologist* 34, no. 1 (1993).

Ontario Injury Prevention Resource Centre, "Best Practice Programs for Injury Prevention," (Toronto, ON: Ontario Injury Prevention Resource Centre, 1996).

## Chapter 4: The Environment

### Risk Management and the Environment

#### *Cultural Dimensions of Risk*

In addition to the psychometric approaches to risk perception discussed in Chapter 3, there are growing traditions of scholarship focussing on the social and cultural dimensions of risk, and in particular of risk perception.<sup>67</sup> In particular there has been a strong challenge to the psychological approach to risk management from the perspective of cultural theory. Anthropologist Mary Douglas, among others, has argued that one cannot divorce issues of risk perception and hazard identification from cultural bias,<sup>68</sup> the shared attitudes and beliefs that help define a particular social environment. From this perspective, it is meaningless to discuss what constitutes a hazard, until one understands what a particular group values and doesn't value.<sup>69</sup> Such cultural bias is characterized in two ways, first the extent to which an individual feels part of a larger social context, called *group*, and second the extent to which social interactions in this context follow rules of conduct, called *grid*. Thus Douglas' theory is most often (at least initially) referred to as *Grid-Group Cultural Theory*. Cultural biases can then be classified into one of four quadrants based upon whether they are high or low group, and high or low grid (see Table 10).

**Table 10 Four Grid-Group Culture Biases<sup>70</sup>**

	<b>High Group</b>	<b>Low Group</b>
<b>High Grid</b>	Hierarchists	Fatalists
<b>Low Grid</b>	Sectarians/Egalitarians	Individualists

Each of the above orientations can also be linked to one of four beliefs about the nature of nature itself.<sup>71</sup> The individualist tends to see nature as *benign*, subject to perturbation but able to reassert homeostasis. The egalitarian on the other hand sees nature as *ephemeral* in a state of precarious balance, susceptible to catastrophic perturbation. Hierarchists tend to see nature as *perverse/tolerant* as blending of the above two positions. Finally, fatalists see nature as *capricious*. These views of nature in turn impact upon the types of interventions one is likely to see as beneficial in dealing with probabilistic outcomes, or indeed whether one believes one should intervene at all in the case of fatalists.

Not only does the social environment shape the discussion of hazards and the perception of risk, it is likely to be of central concern in such discussions itself. As Pidgeon summarizes it:

It is an assumption in much of sociology and anthropology that one of the things that people value most (and which shapes their perceptions and behaviour) will be the set of social arrangements or institutions that they personally strongly identify with or participate in. In the context of risk perception therefore, the hazards that are likely to be of particular concern are those that pose threats to locally valued social and institutional arrangements, or to other elements that are central to a particular way of life.<sup>72</sup>

Thus what a particular group considers a risk, is a function not only of objective probability of physical harm, but that which poses a threat of cultural erosion.

Individuals and groups will call certain behaviours, objects, technologies, etc. risky as part of their cultural boundary maintaining mechanisms. Naming something a risk allows one to defend against practices counter to one's preferred lifestyle, and more cynically it becomes a potential weapon for assigning blame to other groups.<sup>73</sup> Indeed, Douglas goes so far as to claim that the shift in meaning of risk, from the probability of outcomes, both good and bad, to one synonymous with danger fulfills the needs of post-modern culture saying:

The modern risk concept, parsed now as danger; is invoked to protect individuals against encroachments of others. It is part of the system of thought that upholds the type of individualist culture which sustains an expanding industrial system.<sup>74</sup>

There have certainly been critics of the contributions of culture-theory to the study of risk perception, and especially to its more strongly written indictments of post-modern society. However, there can no longer be any doubt that it is valuable to consider issues of risk perception at a scale larger than the individual.<sup>75</sup>

### ***Organizational Risk Management***

When discussing risk management in organizations, the question of the culture of organizational management naturally arises. In other words, the environment under concern, is the social environment of organizations, within which a given organization is attempting a risk management strategy. The environment has been characterized in a number of ways. First there is the set of informal, and occasionally formal, "rules of the game" which describe the way risk management is conducted in institutions. Ostram summarized these in a six-dimensional framework,<sup>76</sup> later adapted by Hood, et. al. in their 1992 report to the Royal Society. The six general dimensions of rules governing the culture of risk management are as follows in Table 11.

**Table 11 Dimensions of Risk Management<sup>77</sup>**

<b>Rule Type</b>	<b>Explication</b>	<b>Range of Keys/Types</b>	<b>Trends</b>
Boundary	Who is counted as a player?	Technocratic / participative	More participative
Scope	What is managed and what can be decided?	Broad / Narrow	Extension of scope
Position	What is the hierarchy of players?	Single Organization / Multi-Org.	More Multi-Organizations
Information	Who is entitled to know what from whom?	Open / Closed	More Open
Authority / Procedure	Under what conditions must decisions be made?	Formal / Informal	More Formal
Preference Merging	How are individual preferences aggregated into collective decisions?	Consensus (integration) / Conflict (Aggregation)	More Conflict

Boundary rules are those that limit access to the risk management process. Scope rules describe, naturally enough, the scope of risk management activities within and between organizations. Position rules refer to the choice points within the risk management process, for example delineating who can initiate a legal proceeding, etc. Information rules are those that limit, or permit, access to classes of information within the risk management process. Authority and Procedural rules provide the decision-making frameworks for risk management. Finally, preference-merging rules specify the ways in which the preferences of individual stakeholders are negotiated in the decision process.

The trends along each of these dimensions in the middle of the 1990s are given in the final column of Table 11.

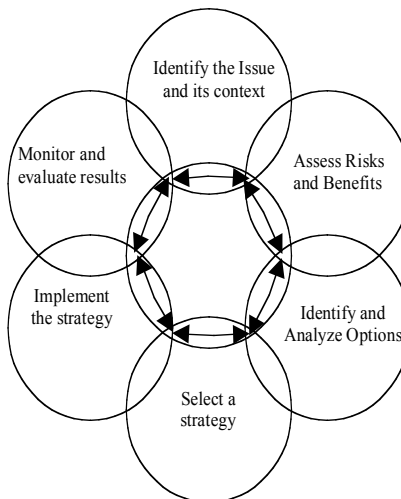
An example of institutional change, within the context of these dimensions, is the recent adoption of a new decision making framework for risk management within Health Canada, a change along the Authority / Procedure dimension. The original framework from 1989, revised in 1993, as part of the old Health Protection Branch was a linear framework with clear distinction between risk analysis and risk management. Note that the decision forms the bridge between the two major stages.

**Figure 3 Health Canada Risk Management Model from 1989<sup>78</sup>**

<b>RISK ANALYSIS</b> 1. Hazard Identification 2. Development of Options 3. Decision
<b>RISK MANAGEMENT</b> 3. Decision 4. Implementation 5. Monitoring 6. Review

By the mid 1990s new values in particular were in play: public desire for a more transparent process, and increased public participation, increased need for accountability, and a recognition that such processes are not always linear. Circa 1997, as part of the general transition in health protection and promotion to population health the framework was changed to:

**Figure 4 Health Canada Decision-Making Framework for Risk Management<sup>79</sup>**



In addition to the six dimensions of rules governing the organizational culture of risk management there are a number of larger issues that are in play as a whole. Hood, et. al. define seven different doctrinal contrasts, defined as opponent pairs of perspectives on risk management in each of these dimensions. Collectively, these doctrinal contrasts lay out the domain of dispute about the proper role and nature of risk management within



institutions. In short, they provide a map of the social environment of risk management, summarized in Table 12.

**Table 12 Doctrinal Contrasts in Risk Management<sup>80</sup>**

<b>Doctrine</b>	<b>Justification</b>	<b>Counter-Doctrine</b>	<b>Justification</b>
Anticipationism	Apply causal knowledge of system failure to ex ante actions for better risk management	Resilience	Complex system failures are not predictable in advance and anticipationism makes things worse
Absolution	A "no-fault" approach to blame avoids distortion of information and helps learning.	Blamism	Targeted blame gives strong incentives for taking care on the part of key decision-makers.
Quantificationism	Quantification promotes understanding and rationality, also exposes special pleading.	Qualitativism	Proper weight needs to be given to the inherently unquantifiable factors in risk management.
Design	Apply the accumulated knowledge available for institutional design.	Design Agnosticism	There is no secure knowledge base or real market for institutional design.
Complementarianism	Safety and other goals go hand in hand under good management.	Trade-offism	Safety must be explicitly trade off against other goals.
Narrow Participation	Discussion is most effective when confined to expert participants.	Broad Participation	Broader discussion better tests assumptions and avoids errors.
Outcome Specification	The regulatory process should concentrate on specifying structures or products.	Process Specification	The regulatory process should concentrate on specifying institutional processes.

### ***Lessons for SMARTRISK***

1. Individuals are defined, in large part, by their cultural affiliations and roles.
2. Within given cultures, risks and risk taking may be viewed differently. It is a potential danger of the formal theories of risk management, to assume as much homogeneity of people as they do.
3. People may advocate quite different levels and types of intervention based upon their cultural biases and consequent view of nature. Despite these radical differences all can be quite genuine in their desire to make the best, most rational, choices.
4. Risks are always taken relative to values. One of the greatest values individuals may have is their membership in a particular cultural group. Threats to that membership, or indeed to the cohesion of the group as a whole, are likely to be evaluated ahead of risks of personal injury.
5. Culture in organizational risk management is most likely to occur along lines defined by a family of largely unwritten rules.
6. In order to implement change at the organizational level one must also be aware of the various doctrinal controversies currently in play.
7. For example, strategies to anticipate and prevent injury causing events, may not be as effective as strategies aimed at promoting resilience, mitigating the effects of the event. However, there are likely to be forces resisting such changes in emphasis on doctrinal grounds.

## Safety and the Environment

### *Engineering is Primary Means*

When considering the 3 Es of safety as tools to improve safety at the level of the environment, the obvious tool of choice is engineering. A great deal of effort has been made to produce safer roadways, build better bridges, and engineer the environment to reduce the risk of loss, both of property and life and health. For just one example, there have been massive efforts at flood control in the United States, which has opened up vast new areas for settlement and development without the regular risk of flood damage. Seen as a strategy to reduce the number of flooding events, these efforts have been tremendously successful. However, if the goal was the reduction of loss and injury due to flood the statistics suggest that these efforts have largely been a failure.<sup>81</sup>

Gerald Wilde provides an explanation for this somewhat paradoxical result in his work, *Target Risk*, in which he claims:

We now have a plausible explanation for the fact that the technological efforts toward flood control in the USA failed to reduce the number of flood victims. Improved impoundment and levee construction did make certain areas less prone to flooding. But, as a consequence, more people settled in the fertile plains, because these now appeared 'safe enough'. The end result was that subsequent floods, although fewer in number, caused more human loss and more property damage.<sup>82</sup> If one wishes to reduce the problem of excessive flow of water, it would seem more sensible to seek a solution *upstream*--for instance in the form of reforestation or the careful maintenance of wetlands--so that more-than-normal precipitation is contained and does not run downhill.<sup>83</sup>

We will discuss the theory of risk homeostasis further in Chapter 5, for now it is simply worth noting that often the success or failure of a particular engineering solution is dependent upon how one defines one's goals.

### *Enforcement*

Similar problems can be seen in attempts to use enforcement as a strategy to create safer environments. Prohibiting access to particularly unsafe environments, and enforcing regulations on the construction of the built environment are classic means by which enforcement is used for safety at the environmental level. Building codes are an example of the latter strategy. The provision and enforcement of such codes, along with period reassessment of them, would seem to be a good way to ensure that safe built environments can be produced and maintained. Indeed this is the historical motivation for the existence of building codes. In practice, however, it is notoriously difficult to get such codes opened up for review in light of new evidence of safety concerns.<sup>84</sup> The fact is that such regulations are enmeshed in a complex web of political and commercial concerns, and thus the motivation to produce a safer built environment must often take a back seat to other issues.

Enforcement is also used to create safer environments through the use of areas of increased monitoring for traffic offenses. For example, there is the recent adoption of red light cameras in Ontario in an effort to promote safer driving. Archard tells how during the development of the program in Ontario, a key element from other jurisdictions where they had been used was omitted—the warning signs. If the purpose were to deter

reckless driving the warning signs would actually be as useful as the cameras themselves. However, one member of the steering committee implementing this policy apparently said that placing warning signs would “defeat the purpose,” here clearly envisaged as making more arrests, and garnering more fines.<sup>85</sup>

### ***Education***

Education in an environmental context about safety and risks often takes the form of posted warnings. Such signs as, "Danger Water's Edge," are commonplaces of our society. While there is not complete consensus on the utility or best practices for such hazard warnings, there is a large body of research on precisely what constitutes a good warning sign. Indeed there is a sense in which this has been a major focus of research in the safety community for a number of years.<sup>86</sup>

One can also look at the indirect effects of such messages. For one salient example, the mere fact that newspapers and radio stations began publishing U.V. indexes may have had more to do with people changing their sun exposure behaviour than any specific warnings about skin cancer.<sup>87</sup> Indeed, one could envisage such a strategy of compiling societal indexes for a number of risk factors (such as traffic) after the increased surveillance, suggested above, has yielded sufficient information to allow for such indexing.

### ***Lessons for SMARTRISK***

1. Reducing the incidence of injury causing events, does not necessarily reduce the rate or severity of injuries.
2. Strategies to promote safety or reduce injuries are made within socio-political contexts. Often there are mixed or even conflicting motives behind initiatives, which may reduce the effectiveness of the initiatives.
3. When deciding upon communication strategies one should consider the potential indirect effects, as well as the obvious intended consequences.

## **Injury Prevention and the Environment**

### ***Consequences***

The focus on consequences in injury prevention related to the environment takes the form of surveillance. In recent years there have been increasing attempts to get epidemiological measures of the incidence of unintentional injury. Such epidemiological measure can be used to create hazard maps of the environment, and chart spatio-temporal patterns in injury causing incidents. Such practices have much in common with the long-standing reliability procedures in the Organizational Health and Safety tradition.<sup>88</sup>

For just one example, there are the ongoing regulatory requirements for reporting adverse incidents in chronic care facilities for the elderly, including all falls.<sup>89</sup> What is perhaps more surprising is that while such initiatives at increased surveillance have begun, it is often the case that such data, once collected, goes completely unexamined.<sup>90</sup> Finally, there is the problem of collecting data outside of an institutional context, especially when the individuals involved are often motivated to downplay the incidence of falls and their severity when they occur.<sup>91</sup>

### ***Strategies to Reduce Injuries***

Again taking our example of preventing injuries due to falls in the elderly, there are a number of ways one might approach this problem from an environmental perspective. One can attempt to create an environment that is less likely to produce falls, and/or less likely to result in injury, should falls occur. As an example of this strategy there was a movement in the architectural design of long term care institutions for the elderly to eliminate stairs, in favour of ramps, and same-floor living, recreation and dining facilities. Such engineering did indeed result in the reduction of falls, however it also had a deleterious impact on the mobility of the residents. A certain amount of challenge in the environment, with its attendant risks, is necessary to maintain capacity for action. Researchers refer to this phenomenon as *Environmental Press*.<sup>92</sup>

A second approach is to make the environment safer by increasing monitoring. Research has shown that injury causing falls in the elderly increase in incidence sharply during periods of lower staffing. In one study, Gallagher reported that falls reached peak levels between 5pm and 7pm when the turnover between afternoon and evening shifts was taking place, and when many of the overlapping staff members were taking dinner breaks.<sup>93</sup> While one can certainly argue that increased monitoring will not be the solution to all issues of safety, or even a socially desirable one in a free society if it were, it is noteworthy that the fact that the problem in this one facility was due to monitoring shortages was only discovered thanks to increased environmental surveillance, as recommended above.

### ***Lessons for SMARTRISK***

1. Increased surveillance could yield many dividends in the understanding of the circumstances that make injuries more likely, and more severe.
2. Such dividends can only be reaped, however, if the information can be collected, particularly in contexts other than formal institutions.
3. Further, this information can only be of use if it is made available and examined once collected.
4. Within institutional settings, monitoring has been determined to play a key role in the prevention and attenuation of injury causing events.
5. The benefits of increased monitoring, however, must be weighed against societal values of self-determination and privacy.

### **Notes**

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<sup>67</sup> S. Krimsky and D. Golding, eds., *Theories of Risk* (New York: Praeger, 1992).

Pidgeon et al., "Risk Perception,".

<sup>68</sup> M. Douglas, "Cultural Bias," in *The Active Voice* (London: Routledge & Kegan Paul, 1982).

<sup>69</sup> M. Douglas, *Risk Acceptability According to the Social Sciences* (New York: Russell Sage Foundation, 1985).

<sup>70</sup> Pidgeon et al., "Risk Perception,".

<sup>71</sup> Adams, *Risk*.

<sup>72</sup> Pidgeon et al., "Risk Perception,"., 112.

<sup>73</sup> M. Douglas, *Risk and Blame* (London: Routledge, 1992).

<sup>74</sup> *Ibid.*, 7.

Pidgeon et al., "Risk Perception,"., 113.

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- <sup>75</sup> A. Grinyer, "Risk, the Real World and Naive Sociology," in *Medicine, Health and Risk: Sociological Approaches*, ed. J. Gabe (Oxford: Blackwell, 1995).
- <sup>76</sup> E. Ostrom, "A Method of Institutional Analysis," in *Guidance, Control and Evaluation in the Public Sector.*, ed. F.X. Kaufman, G. Majone, and V. Ostrom (Berlin: de Gruyter, 1986).
- <sup>77</sup> Adapted from C.C. et al. Hood, "Risk Management," in *Risk: Analysis, Perception and Management*, ed. Sir Francis Graham-Smith (London: The Royal Society, 1992), 149.
- <sup>78</sup> Sheryl Bartlett, Interview, November 23 2000.
- <sup>79</sup> Ibid
- <sup>80</sup> First described in Hood, et. al., 1992 later developed further in Christopher Hood, and David K.C. Jones, ed., *Accident and Design: Contemporary Debates in Risk Management* (London: UCL Press, 1996).
- <sup>81</sup> W.C. Clark, "Witches, Floods and Wonder Drugs," in *Societal Risk Assessment: How Safe Is Safe Enough?*, ed. R.C. Schwing and W.A. Albers (New York: Plenum Press, 1980).
- <sup>82</sup> Ibid.,.
- <sup>83</sup> Gerald J.S. Wilde, *Target Risk* (PDE Publications, 1994 [cited January 2001]); available from <http://pavlov.psyc.queensu.ca/target/>.
- <sup>84</sup> Nancy Edwards, Workshop Participant, January 17 2001.
- Elaine Gallagher, Interview, January 24 2001.
- <sup>85</sup> Archard.
- <sup>86</sup> William Leiss, Interview, November 23 2000.
- <sup>87</sup> Robert Conn, Interview, October 5 2000.
- <sup>88</sup> Interdisciplinary Health and Research Group, *Health and Safety Approaches in the Workplace*, vol. 1 (Hamilton: McMaster University, 1992).
- Ibid.,, vol. 2.
- <sup>89</sup> Ontario Ministry of Health, "Standards: Resident Care," (Toronto: Ontario Ministry of Health, 1998).
- <sup>90</sup> Gallagher.
- <sup>91</sup> Ibid.
- <sup>92</sup> Kathy Shipp, "The Physical Environment as a Determinant of the Health Status of Older Populations," *Canadian Journal on Aging* 18, no. 3 (1999).
- <sup>93</sup> Gallagher.

## Chapter 5: The Interaction

### Risk Management and Interaction

#### *How Individuals Get Information about Risks: Risk Communication*

In the past 20 years a relatively new development in the literature on risk has been the growth of the field of Risk Communication. Pidgeon, identifies one of the reasons for this increased interest in risk communication:

In practical terms there is an increasing requirement, both in legal as well as moral terms, placed upon government and private industry to inform populations about the environmental, technological, and health hazards to which they might be exposed. Such communications may have the goal of encouraging a particular behaviour to guard against an immediate individual risk (e.g. the use of condoms as a precaution against HIB infection), or in the context of large-scale societal risks, such as those of a flood or toxic release, communication may be a statutory part of the emergency planning process...<sup>94</sup>

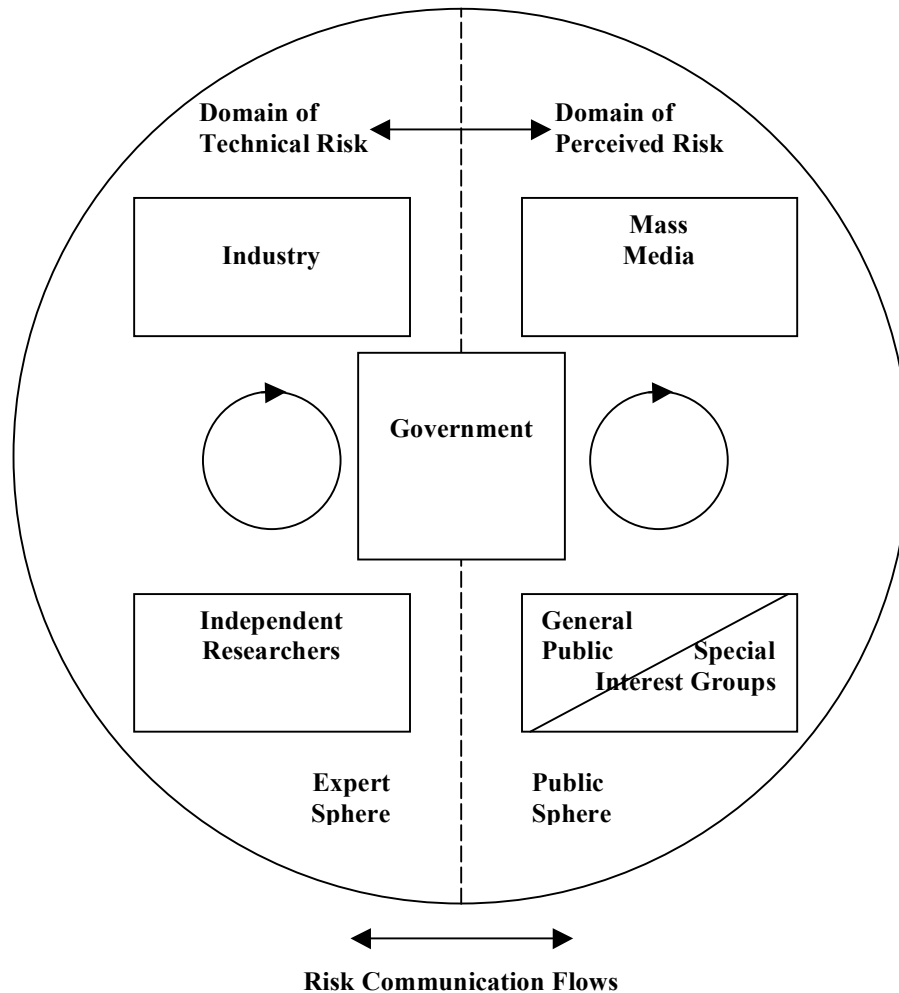
Additionally, it has been suggested that the increased interest in risk communication stems from the presence in recent years of some highly visible policy logjams, over such issues as hazardous waste management. In the context of heated public controversy over issues it is only natural that there would be increased interest in researching which forms of risk communication work, and which do not.

The situation is made complex by the fact that often risk communications are not simple in either content or desired effect. In fact, Otway and Wynne, in a seminal paper in the field, argue that often risk communicators face the challenge of needing to simultaneously achieve goals, which would seem to be at cross purposes to one another. For example, considering their *assurance-arousal paradox* in many situations it is the goal of the risk communicator to assure the public that a given situation presents only a minimal risk at present, yet also to alert them to the fact that more serious risks could arise later.<sup>95</sup>

There has been considerable debate within the research on risk communication as to precisely what the nature of that communication is. Those in an older safety engineering tradition, often tend to view the communication process as one-dimensional, with expert assessments of risks being distributed top-down to the general public. Others tend to favour a more complex account of risk communication, which takes into account not only the direct communication of risk information from experts to the public, but within those two communities, and within the larger context of socio-political discourse in general. One such framework developed by Leiss and Krewski is called the Communication Processes Model of Risk Communication (see Figure 5).

This model has two key features. The first is the emphasis upon risk communications within two broad zones, that of expert discourse and that of public discourse, with the government straddling this divide. The second is the bi-directional flow of information across this divide, emphasizing the interactive nature of risk communication both within and between broad domains of discourse.

#### **Figure 5 The Communication Process Model of Risk Communication<sup>96</sup>**



Parties within these two spheres speak fundamentally different languages, and within these two spheres risk communication often serves quite different purposes. Naturally, this leads to difficulties. The expert sphere is the domain of technical risk where the language of choice is quite rigorous and often risks are expressed in mathematical terms. The public sphere is the domain of perceived risk, where the language is non-technical, and mathematical subtleties of different levels of probability, to say nothing of differing views of probability, are lost.<sup>97</sup>

A question that might naturally arise is where risk perception, as traditionally viewed from a psychological standpoint, resides under this model. The answer is that it is implicit in each flow of risk communication both between different individuals, and groups within each sphere, and especially in the transactions between the spheres. According to Leiss, the communication between these spheres is further complicated because:

The inherent difficulties in communicating research findings from experts to lay audiences are based on incomplete data; on the complexity of theories that necessarily incorporate probabilities, ranges of uncertainties, and choices of extrapolation models; on the unwillingness of many experts to make a genuine

effort to understand public concerns; and on many other factors. These factors foster mistrust of experts on the part of the public.<sup>98</sup>

Thus experts tend to take a didactic stance. While from the public's perspective, their understanding can be limited because:

The public's perception of risk is often inconsistent; risk information by its very nature often frightens the public; strongly held beliefs are hard to modify; and views are easily influenced by the ways in which information is presented. These limitations in turn foster mistrust of the general public and the part of experts.<sup>99</sup>

Finally, there is the issue of mistrust in risk communication created by a climate of corporate and governmental deniability. As long as leaders are more interested in evading blame for mishaps, than in promoting public safety, there will be barriers to effective risk communication.<sup>100</sup>

### ***Risk Homeostasis***

A second recent development in the risk literature that is best characterized in terms of the interaction between individuals and their environment is research on risk homeostasis, pioneered by Wilde. The motivation for Wilde's research was the observation that nearly a century of improvements to safety in construction and engineering techniques, in publication of risk information and in regulating various high-risk behaviours and industries has not significantly reduced the morbidity or mortality rates for injury or "lifestyle-dependent diseases". According to Wilde the reason is that risk functions in the world the way a thermostat does in a home, or more appropriately the way a homeostatic process functions in a living organism. In other words:

In any ongoing activity, people continuously check the amount of risk they feel they are exposed to. They compare this with the amount of risk they are willing to accept, and try to reduce any difference between the two to zero. Thus, if the level of subjectively experienced risk is lower than is acceptable, people tend to engage in actions that increase their exposure to risk. If, however, the level of subjectively experienced risk is higher than is acceptable, they make an attempt to exercise greater caution.<sup>101</sup>

Such a position has many critics. It has been called too pessimistic, and even referred to as *Wilde's Law of Conservation of Misery*.<sup>102</sup> For Wilde, however, a key feature of the theory of risk homeostasis, is that just as any homeostatic process has a set point, that the system as a whole tries to maintain, so to must there be a societal (or perhaps occasionally more local, even personal) set point for risk. The theory doesn't say we can't reduce the incidence of injury from high-risk behaviours, merely that we can't do so while ignoring this societal set point.

In short, the theory of risk homeostasis proposes that a nation's temporal loss due to accidents and lifestyle-dependent disease is the output of a closed-loop regulating process in which the accepted level of risk operates as the unique controlling variable. Consequently, if we wish to make an attempt at reducing this misery, that attempt should be aimed at reducing the level of risk accepted by the population.

With this theory as a key, you now have the means to unravel the puzzling findings that have been mentioned so far. As you may have guessed, the key to understanding proposed in this book is the following notion:



[Emphasis Original] *People alter their behaviour in response to the implementation of health and safety measures, but the riskiness of the way they behave will not change, unless those measures are capable of motivating people to alter the amount of risk they are willing to incur.*<sup>103</sup>

Obviously, this highlights how much more complex the situation is, when one attempts to intervene to reduce injuries. Consequently, any future strategy will have to be made by people comfortable in dealing with this complexity.

### **Regret**

One of the key principles of normative decision theory as described above in Chapter 3 is the assumption that individuals will attempt to maximize their expected utility with the decisions they make. In other words, they will select one of the decision rules listed such that they gain as much as possible, or at the very least, lose as little as possible. There has been considerable work in descriptive decision theory showing that often real decision-makers, whether individual or corporate, do not behave this way. Traditionally, researchers have considered such departures from the maximization of utility to be lapses in rationality, and have offered numerous logical and psychological explanations for why such behaviour might occur.

More recently, there have been researchers that have demonstrated that in many cases, subjects are not only acting to make the most favourable decision, at present, but also to minimize potential future regrets from lost opportunities.<sup>104</sup> This newer principle in decision theory is known as *regret*. Initially little more than another psychological explanation for lapses of rationality, it has grown as a concept into the idea of another set of utilities that decision makers must consider if they are to be considered rational at all. Thus not only has descriptive decision theory been modified by the concept of regret, but also normative decision theory.<sup>105</sup> Accordingly the list of decision rules from Chapter 3 has been amended to include a decision rule called *minimax regret* which takes into account not only the potential risk of worst case outcomes, but also the lost potential opportunities should a more favourable state of the world obtain.<sup>106</sup>

Understanding that when individuals make decisions that seem to entail too much risk, they may also be balancing the reduction of potential regret will be crucial to any future serious attempts at risk communication with behaviour change as its goal.

One example immediately comes to mind. As we were preparing this document a particular incident occurred, which brought some of these issues to life. We were told the tale of an elderly couple in their late eighties who had been married for over 60 years. They had great pleasure in each other's company, travelled and walked every day. The husband fell and broke his hip. As he was recovering he was given Beta-blockers for a chronic, serious heart condition, which made it difficult for him to retain his balance while walking. It took him several weeks to convince the doctors that his mobility was critically important to him and that they should reduce the medication so that he could begin to walk again. He was prepared to accept the risk, to reduce the future regret of loss of mobility, but it took the doctors a while to understand this. Note that as this example illustrates, often the situations giving rise to potential regret are those involving interactions with one's social context.

### ***Are all Risks to be Avoided? The Developmental Uses of Risk***

While it was noted above that the term risk carries no particularly negative connotation in the context of formal decision theory, nonetheless it does in common discourse. In fact, much of this paper has slipped into common usage seeing risk as something to be avoided or at least minimized. However there is some reason to believe that a certain amount of exposure to risk may be necessary, even beneficial. Social scientists while recognizing the importance of security to healthy development also emphasize the importance of interaction with an enriched environment as equally important.<sup>107</sup>

Actively interacting with an enriched environment carries with it increased risks of negative events such as injuries. However, it has been demonstrated that the lessons of self reliance and resiliency under stress learned from this increased level of risk can have enormous impact in how individual will deal with stressful situations later in life.<sup>108</sup> The key to such experiences being enriching and not devastating seems to be the quality of the interaction between the developing child and their social context, especially the security of their attachment to their parents.<sup>109</sup>

### ***Decision Theory becomes Game Theory***

Finally, there are the modifications to mathematical decision theory that occur when one assumes that one is not making decisions only in the context of probabilistic but presumably passive states of the world, but rather when one's decisions are made against the decisions of another rational agent. Such situations are called games, and the theory of games is an important adjunct to the rest of decision theory. Assuming that one is not deciding among outcomes based upon the state of the world, but rather based upon another person's decisions changes the very proscriptions of rational behaviour under the normative theory.

For example, in Chapter 3, the *maximin* principle was described as very pessimistic, since one made one's choices under that assumption that the worst case possible would obtain. When one is making choices from amongst a set of alternatives and the possible states are the alternatives another is choosing from, and that other person has interests opposed to yours, the maximin decision rule is not only far from pessimistic, it is the only rational choice.

For a classic example that relates to unintentional injury consider the game of *chicken*, two adolescents driving their vehicles at one another on a deserted stretch of roadway at night. The first to swerve away from the potential collision is branded a chicken. It is instructive to note that it is the most individually rational course of action, for each player that leads to ultimate disaster for both. Thus when discussing taking smart risks with individuals, it is important to consider the social context of the decision, and to remind people that often what is individually the most rational course of action, may not be so, when one is faced with competing individual and communal goods.

### ***The Risky-Shift Effect***

There is a research tradition that has found that subjects in groups are willing to make riskier decisions than subjects evaluated on their own.<sup>110</sup> This phenomenon has been dubbed the *Risky Shift*. While there is little disagreement about the existence of the phenomenon, there are competing research traditions offering quite different explanations

for it, such as: *diffusion of responsibility, persuasion, familiarization, and cultural value*.<sup>111</sup>

Diffusion of responsibility in this context means that the potential regret for harm caused by an individual decision, is mitigated by the presence of others during the decision making process. Thus one is freed from the idea that one, as an individual, has harmed another (or oneself) by taking a risk, in much the same way that inhibitions are released in incidents of mob violence.

The persuasion hypothesis is that individuals or groups in dominant positions are able to sway other group members. Given that such dominant individuals or groups are likely to be more aggressive in nature, their persuasion will often be in the direction of increased risk taking. For example, it has shown on occasion that individuals in a group that have behaved more in a riskier way, often show less variability in their individual risk proneness, presumable due to the influence of persuasion.

The familiarization hypothesis assumes that individuals are often more risk averse due to lack of familiarity with a given hazard. Under this hypothesis, group discussion serves to familiarize new members, and thus reduce fear of the unknown (See Chapter 3--Risk Perception, above).

Finally, the cultural value hypothesis assumes that some groups are more risk prone as part of their cultural boundary maintaining mechanisms. Individuals valuing membership in such groups are therefore encouraged, out of a sense of group loyalty, to adopt a more risk tolerant orientation. This is a likely explanation for much of the increased risk taking seen in social groups of adolescent males, for example.

Regardless of the cause, or more likely causes, of this effect. It is a significant finding that groups will often behave in a more risk prone fashion than individuals. The implications for social marketing and policy making are likely to be great. However, one must note that this research tradition has come under harsh criticism by social scientists who have found that often groups make better assessments of risk, and safer choices than individuals.<sup>112</sup>

### ***Lessons for SMARTRISK***

1. Risk communication is not as simple as experts telling the public what they should beware of. Rather, there are numerous communication dynamics both within the community of experts and within the general public that interact in complex ways.
2. Initiatives aimed at reducing the injuries from a particular class of incidents are doomed to fail unless they can also provide incentives for changing the public's tolerance for risk within those contexts.
3. When making decisions, individual do not only evaluate the potential benefits and gains from each course of action, but also the potential regret for courses of actions not chosen.
4. Risk taking is not always negative, indeed it seems to be necessary for normal development.
5. Individuals in groups often behave in a riskier manner than when alone. Social marketing for culture change is thus more likely to work than safety education for individual behaviour change.

## **Safety and Interaction**

### ***Enforcement is Primary Means***

Considering safety from the perspective interactions it seems natural to turn to the third E, enforcement. What is interesting to note is how often regulation can serve as a surprisingly effective tool for culture change. For example, consider the seatbelt legislation discussed above. One might debate how many injuries have actually been prevented by the adoption of seatbelt legislation in Canada, however, what seems clear is that between the 1970s and the present day, the car culture of Canadians has changed, such that for many Canadians it is inconceivable to sit in a vehicle without a restraint. Thus one should not only consider the potential direct effect of enforcement of regulations as a deterrent to future unsafe behaviour, but also as a potential tool to shape cultural attitudes toward safer behaviour.

This is not a universal panacea however. Consider the regular periods of increased enforcement of laws against impaired driving, for example the RIDE program in Ontario (originally standing for Reduce Impaired Driving in Etobicoke--now Everywhere). A similar program in British Columbia seemed to have its desired effect; traffic injuries where alcohol was a factor were reduced by 18% in the period immediately after this enforcement blitz. However, such success must be examined in the context of the overall increase in other traffic injuries during this same period by 19%.<sup>113</sup> A finding that might best be interpreted in terms of risk homeostasis (see above).

### ***Engineering***

There are also surprising interactive results when one considers safety engineering from this perspective. For example, there is the well-known case of increased incidence of speeding in drivers who have recently purchased a care with ABS brakes.<sup>114</sup>

### ***Education***

Finally, there is the potential to educate people about safety issues from the perspective of interaction with one's social context. A clear example of this is the program called Elmer the Safety Elephant. Originally introduced in 1947 by the Toronto Telegram, in response to rising numbers of school-age children being hit by cars, the program has just recently been reintroduced by the Canada Safety Council.

Each school is issued an Elmer the Safety Elephant flag to fly. When there is a traffic injury involving one of the students at the school, the flag is taken down for a prescribed period of time. It is restored after a suitable incident-free period. The presence or absence of the flag raises the issue of safety consciousness for the students, but interestingly it is not an intervention at the individual level alone. Students are encouraged to take fewer risks around traffic, not only to avoid personal injury, but also in order to maintain the social cohesion of their school. The intervention works at the level of the interaction between the individual student and their social environment, encouraging safer behaviour so as not to "let down one's school."<sup>115</sup>

### ***Lessons for SMARTRISK***

1. As noticed throughout this report there are numerous potential interventions within any given orientation.

2. Often, due to the complexity of the interactions within a given context, the outcome of a given intervention can be quite different than what was anticipated. Thus numerous, small-scale, local initiatives are more likely to produce a few successes than fewer, more ambitious, and more centralized initiatives.
3. Successful education for safety, again, is often more a matter of creating a culture of safety, than of imparting facts and figures.

## **Injury Prevention and Interaction**

### ***Consequences***

Considering the consequences of unintentional injury from the perspective of interactions means going beyond the impact of the injury on the injured individual. There is certainly evidence that caring for an injured loved one is both emotionally and financially draining for a family, however there are even larger contexts with which individuals interact that are worth examining. SMARTRISK has recently commissioned a pair of reports on the *Economic Burden of Unintentional Injury in Canada*<sup>116</sup>, and *The Economic Burden of Unintentional Injury in Ontario*.<sup>117</sup> Among the disturbing facts uncovered are the fact that nearly 7000 individuals in Canada die as a result of unintentional injury every year, over 2/3 of them as a result of a motor vehicle crash or a fall (See Table 13 below). Even more disturbing than the raw data are the percentages broken down by age group. Nearly 1/3 of the deaths attributable to motor vehicle crashes are of persons under 21 years of age. The conclusion is inescapable; there is a tremendous loss to the nation of potential citizens to participate in our democratic process, and workers to participate in our economic sustainability to preventable, unintentional injuries. Tragic as these losses are for the individuals and families directly involved, there is also the cost to Canadian society to be considered. Analyses such as these are an important step toward understanding the consequences of unintentional injury, from the perspective of the interaction between individuals and their social environments. In the words of the authors, "There are large societal savings that could be realized through preventing and reducing the prevalence of unintentional injury in Canada."<sup>118</sup>

**Table 13 Deaths Resulting from Unintentional Injury, Distribution by Major Category, Canada, 1994<sup>119</sup>**

<b>Major Cause of Death</b>	<b>Number</b>	<b>% Distribution</b>
Motor Vehicle Crashes	2,567	38.3
Falls	2,047	30.5
Poisoning	581	8.7
Drowning and Suffocation	353	5.3
Fires	274	4.1
Other	888	13.2
Total	6,710	100.0

### ***Strategies to Reduce Injuries***

There are also strategies that can be employed to reduce unintentional injuries from the perspective of the interaction between individuals and their environment. One can make risk communication more effective by trying to better understand the whole person and

their situation. Morongiello suggests techniques such as Gibson's Prototype Theory, where by interviewing nonsmoking youth about the image of themselves as smokers, one can ascertain what needs they have and what they value. Interventions can then be targeted at those needs, rather than at the smoking behaviours themselves. For example, for young ladies who feel that smoking will help them stay thin, it is more useful to talk about the fact that on average smokers weigh more than non-smokers than it does to tell them the risks of lung cancer.<sup>120</sup>

For an example of an injury prevention strategy that makes effective use of social interaction one need look no further than the *Heroes* program at SMARTRISK.<sup>121</sup> By incorporating peer counseling, in the form of a student presenter from the local school, one turns a program that could otherwise be just another attempt at social marketing through fear mongering, into a more interactive, and thus effective venue for risk communication.

One can target organizational behaviour at the level of interactions as well. José Blanco argues that power is the fundamental issue that has always precluded a drive toward safety in industry. Freeing people somewhat to *self-organize* not only increases democracy, inclusiveness, etc. but will also yield benefits in both safety and productivity. In terms of risk management, giving people the tools and the opportunity to manage their risks is far better than setting arbitrary safety policies. The threat is of the loss of power, but the good manager realizes that any power lost, was power that wasn't needed to begin with.<sup>122</sup>

### ***Lessons for SMARTRISK***

1. Increased surveillance must include facts other than incidence counts and injury outcomes, if the goal of preventing injuries is to gain policy traction. Noting the impact of injuries on human capital, as in the "*Economic Burden*" papers is an example of such an approach.
2. Again, it is worth noting that education to prevent injuries is most effective when the interactions between the recipients of the message and their social contexts is taken into account.
3. Self-organization is a free good produced by complex dynamic systems. Learning to facilitate and harness this potential will be crucial in developing interventions that can truly promote risk culture change.

## **Notes**

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<sup>94</sup> Pidgeon et al., "Risk Perception," 118f.

<sup>95</sup> H.J. Otway and B. Wynne, "Risk Communication: Paradigm and Paradox," *Risk Analysis* 9 (1989).

<sup>96</sup> Adapted from Leiss and Chociolko, *Risk and Responsibility* 36.

William Leiss and Daniel Krewski, "Risk Communication: Theory and Practice," in *Prospects and Problems in Risk Communication*, ed. William Leiss (Waterloo, ON: University of Waterloo Press, 1989), 100.

<sup>97</sup> Leiss and Chociolko, *Risk and Responsibility*.

<sup>98</sup> *Ibid.*, 37.

<sup>99</sup> *Ibid.*, 37f.

<sup>100</sup> *Ibid.*

<sup>101</sup> From the introduction to Wilde, *Target Risk* ([cited]).

<sup>102</sup> Wilde.

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- <sup>103</sup> Ibid
- <sup>104</sup> David E. Bell, "Regret in Decision Making under Uncertainty," *Operations Research* 30, no. 5 (1982).
- <sup>105</sup> Ron S. Dembo and Andrew Freeman, *Seeing Tomorrow: Rewriting the Rules of Risk* (New York: John Wiley & Sons, Inc., 1998).
- <sup>106</sup> Rapoport, *Decision Theory and Decision Behaviour*.
- <sup>107</sup> Jane Bertrand, "Enriching the Preschool Experiences of Children," in *Determinants of Health: Vol.1 Children and Youth* (Ottawa: National Forum on Health, 1998).
- <sup>108</sup> Clyde Hertzman, "Population Health and Human Development," in *Developmental Health and the Wealth of Nations*, ed. Daniel P. Keating and Clyde Hertzman (London: The Guilford Press, 1999).
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Chris Power and Clyde Hertzman, "Health, Well-Being, and Coping Skills," in *Developmental Health and the Wealth of Nations*, ed. Daniel P. Keating and Clyde Hertzman (London: The Guilford Press, 1999).
- <sup>110</sup> K.L. Dion, R.S. Baron, and N. Miller, "Why Do Groups Make Riskier Choices Than Individuals?," in *Advances in Experimental Psychology, Vol.5*, ed. L. Berkowitz (New York: Academic Press, 1970).
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Wilde, *Target Risk* ([cited]).
- <sup>113</sup> Wilde.
- <sup>114</sup> Archard.
- <sup>115</sup> Ibid.
- <sup>116</sup> The Hygeia Group, "The Economic Burden of Unintentional Injury in Canada,".
- <sup>117</sup> The Hygeia Group, "The Economic Burden of Unintentional Injury in Ontario,".
- <sup>118</sup> The Hygeia Group, "The Economic Burden of Unintentional Injury in Canada,"., 52.
- <sup>119</sup> Ibid.,, 21.
- <sup>120</sup> Morrongiello.
- <sup>121</sup> SMARTRISK, *Heroes Program Website* (SMARTRISK, [cited February 12 2001]); available from <http://www.smartrisk.ca/heroes.html>.
- <sup>122</sup> Blanco.

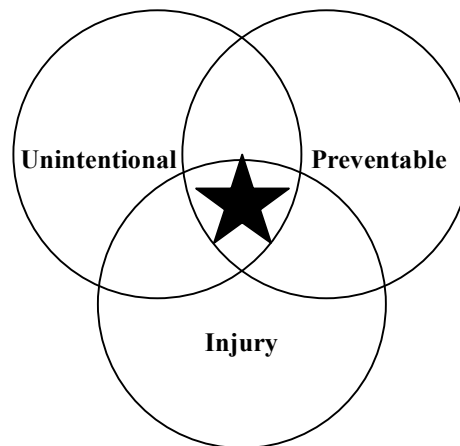
## Chapter 6: Conclusions and Recommendations

### Our Survey Thus Far

In our efforts to map the conceptual geography within which SMARTRISK operates we developed a framework to mark the boundaries of the research domains of Safety, Injury Prevention and Risk Management, developed a conceptual framework for the domain of injury and provided a link to the concepts of the unintentional, the preventable, and injury.

SMARTRISK has traditionally been concerned with preventing unintentional injuries and is thus currently bounded conceptually by the interaction of the domains of what is preventable, what is unintentional, and what is an injury. These three domains also correspond the primary focus of the three domains of research and intervention that SMARTRISK deals with most frequently: Safety, Risk Management, and Injury Prevention, respectively. The framework thus points to how SMARTRISK can benefit from the areas of overlap between these established traditions without having to take on the role of arbitrator in any of the frequent territorial disputes between these areas as wholes, and between the specific organizations and individuals working within each.

**Figure 6 The Traditional Domain of SMARTRISK**



Turning to earlier surveys of the history of the concept of health, it was found that ideas about health and illness tended to cluster into those that focussed on the individual, those that focussed on the environment and finally those that focussed on the interaction between them. It was hoped that it would prove fruitful to examine ideas from the three research and intervention domains surveyed in light of these distinctions. One modification that proved necessary was that when considering individuals, it was important to recognize that in the context of injury prevention, safety and risk management, individuals were as likely to be corporate entities as discrete individual, the essential feature being the level of decision making agency.

The following three chapters examined theories and strategies of risk management, safety and injury prevention from the perspective of individuals, environments and interactions respectively.



## General Conclusions--The Lessons for SMARTRISK

Table 14 presents a summary of the lessons from our survey for SMARTRISK, broken down according to the framework we presented.

**Table 14 Summary of Lessons for SMARTRISK**

	<b>Individuals (including organizations)</b>	<b>Environments (Natural, Built and Social)</b>	<b>Interactions</b>
<b>Risk Management</b>	<p>People perceive risks not on the basis of objective criteria, but often based on the dread that the hazard evokes, and the familiarity of the hazard in their experience.</p> <p>Even when people have access to hard estimates of risks they often don't weigh this information rationally, but rather heuristically. For one example, people often fail to understand that risks can accumulate across time--leading to a sort of "survivor's fallacy".</p> <p>Some people are simply more risk prone in their decision making than others.</p> <p>The formal theories of decision under risk assume some sort of weighting of potential benefits and potential costs by the estimated probabilities of expected outcomes.</p> <p>In practice, decision making is more often expedient and heuristic, with inertia or reduction of panic as core values rather than rationality.</p> <p>In this context, people and organizations are most likely to use risk data post-hoc to bolster their satisfaction with and confidence in the decisions they've made for other reasons.</p>	<p>Individuals are defined, in large part, by their cultural affiliations and roles.</p> <p>Within given cultures, risks and risk taking may be viewed differently. It is a potential danger of the formal theories of risk management, to assume as much homogeneity of people as they do.</p> <p>Risks are always taken relative to values. One of the greatest values individuals may have is their membership in a particular cultural group. Threats to that membership, or indeed to the cohesion of the group as a whole, are likely to be evaluated ahead of risks of personal injury.</p> <p>Culture in organizational risk management is most likely to occur along lines defined by a family of largely unwritten rules.</p>	<p>Risk communication is not as simple as experts telling the public what they should beware. Rather, there are numerous communication dynamics both within the community of experts and within the general public that interact in complex ways.</p> <p>Initiatives aimed at reducing the injuries from a particular class of incidents are doomed to fail unless they can also provide incentives for changing the public's tolerance for risk within those contexts.</p> <p>When making decisions, individuals do not only evaluate the potential benefits and gains from each course of action, but also the potential regret for courses of actions not chosen.</p> <p>Risk taking is not always negative, indeed it seems to be necessary for normal development.</p> <p>Individuals in groups often behave in a riskier manner than when alone. Social marketing for culture change is thus more likely to work than safety education for individual behaviour change.</p>
<b>Safety</b>	<p>People are not just "risk takers" they make decisions balancing many different classes of needs. Education must consider the whole person, and their whole psychology, not just seek to impart information about "objective risks."</p> <p>Engineering of better gear for individual safety is probably less important than successfully marketing that gear. Thus an interactive orientation is probably preferable to an</p>	<p>Reducing the incidence of injury causing events does not necessarily reduce the rate or severity of injuries.</p> <p>Strategies to promote safety or reduce injuries are made within socio-political contexts. Often there are mixed or even conflicting motives behind initiatives, which may reduce the effectiveness of the initiatives.</p> <p>When deciding upon communication strategies one should consider the potential</p>	<p>As noticed throughout this report there are numerous potential interventions within any given orientation.</p> <p>Often, due to the complexity of the interactions within a given context, the outcome of a given intervention can be quite different than what was anticipated. Thus numerous, small-scale, local initiatives are more</p>

individual one in these cases. While adopting different orientations (individual, environment, interaction) seems to suggest a different emphasis on each of the Three Es of Safety, one must recognize the potential for benefits from unanticipated sources--for example the culture change around seatbelt use that resulted from a legislative intervention.

indirect effects, as well as the obvious intended consequences.

likely to produce a few successes than fewer, more ambitious, and more centralized initiatives. Successful education for safety, again, is often more a matter of creating a culture of safety, than of imparting facts and figures.

### **Injury Prevention**

In social marketing of risk information there is the potential for a negative outcome, as fear-mongering often glamorizes the activity in question. Injury prevention initiatives targeted solely at individuals are often not as successful as those focussing on culture change, and environmental enrichment.

Increased surveillance could yield many dividends in the understanding of the circumstances that make injuries more likely, and more severe. Such dividends can only be reaped, however, if the information can be collected, particularly in contexts other than formal institutions, and if it is made available and used once collected. Within institutional settings, monitoring has been determined to play a key role in the prevention and attenuation of injury causing events. The benefits of increased monitoring, however, must be weighed against societal values of self-determination and privacy.

Increased surveillance must include facts other than incidence counts and injury outcomes, if the goal of preventing injuries is to gain policy traction. Noting the impact of injuries on human capital, as in the "*Economic Burden*" papers is an example of such an approach. Again, it is worth noting that education to prevent injuries is most effective when the interactions between the recipients of the message and their social contexts is taken into account. Self-organization is a free good produced by complex dynamic systems. Learning to facilitate and harness this potential will be crucial in developing interventions that can truly promote risk culture change.

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Each of the orientations: Individuals, Environments and Interactions, have produced bodies of research that can inform SMARTRISK's approach to the field of preventable injury. For example, one could examine these findings to see how they bear upon SMARTRISK's five key messages: Drive Sober, Buckle Up, Look First, Wear the Gear, and Get Trained.

#### ***Drive Sober***

This message goes beyond the simple injunction to not operate a motor vehicle under the influence of alcohol. It is about engaging in higher risk activities actively, as though they required conscious monitoring on your part. In short, drive (or engage in any high-risk activity) as though it was worthy of your attention. The literature on decision making under uncertainty is full of similar injunctions. When one's cognitive resources are strained, either by consumption of psychoactive chemicals, or divided attention, one is less likely to make rational decisions and more likely to rely on heuristics such as

representativeness and availability. Even the literature suggesting that individuals can behave rationally, on their own or in groups, stresses that such behaviour can only occur when one is actively engaged in the task at hand.

### ***Buckle Up***

A simple injunction to make use of readily available and proven risk injury prevention strategies. Taken beyond the context of motor vehicles this message could equally apply to such situations as ensuring adequate supervision of fall-prone elderly persons. The specific example of seatbelts is instructive in that it is a battle that has largely been won, through genuine cultural change. The challenge is to find other ways to change our culture to reduce the incidence and mitigate the severity of injuries.

### ***Look First***

The old adage "look before you leap" is really an exhortation to make judgements about risk taking after examining the available evidence. In the current context this raises the issue of where individuals and groups get such information, namely through risk perception and risk communication. A lesson that seems to be emerging from our analysis of both fields is that it might be more fruitful to spend less time focussing on the real or imagined disparity between risk assessments carried out by professionals and those carried out by amateurs. Rather, we should spend more time seeking to improve communication of risk information both within and between the public and professional spheres.

### ***Wear the Gear***

Similar to Buckle Up, this injunction raises two issues. First there is the question of which strategies of injury prevention are truly "evidence based" and second how one can increase compliance with these. The former question will have to be the focus on ongoing research into which interventions make a difference, particularly in the context of risk homeostasis and risk migration. The second, is one of safety education and social marketing. Here the research cited has somewhat more to say. In general, the traditional approach of simply proclaiming the benefits of a strategy or developing rules mandating its adoption, have not proven successful. Again, what does work is attempting to affect genuine culture change. In order to do this, one must be sensitive to individual and cultural differences, as well as aware of the targets of such messages as whole persons (or organizations) balancing many needs of which injury reduction is but one.

### ***Get Trained***

While this message is primarily directed at increasing one's skill set relevant to a particular risk domain (such as driving) there is also the question of whether we could teach our children how to be better risk takers in general. Again the survey of the literature suggests that this may be possible, but that any attempt to do so that ignores the complexity of an individual's make up, needs, and interactions with their environment, is doomed to failure from the outset.

## **More General Findings**

Table 14 illustrates how the domains of Safety, Risk Management and Injury Prevention have also produced various interventions that could serve as models for SMARTRISK's

future work. While the specific lessons can be read from the table, a number of more general points seem worthy of mention.

First, there is the fact that the majority of interventions made by each of the three fields have been targeted at either individuals (including corporate ones) or environments. Second, there is a large body of research, yielding quite interesting results, that has been largely untranslated into policies and programs within the interaction perspective. Third, the research domains and policies and programs aimed at individuals and environments are well established, populated by numerous organizations from charities and NGOs to governmental secretariats and offices at levels ranging from the municipal to the federal. In particular, the field of Safety, aimed at personal (and organizational) behavioural change, and hazard prevention and control has had a long and ongoing history of policy traction.<sup>123</sup> Fourth, the much more dynamic account of injury prevention that considers the interactions between individuals or organizations and a multiplicity of environmental factors appears to be the area where SMARTRISK has concentrated much of its activity. The changing nature of acceptable and indeed beneficial risk as various factors change, the different and changing levels of risk tolerance among individuals and organizations, and the consequent necessary variation in strategies for injury prevention are at the core of the SMARTRISK approach. It is clear that this approach takes into account the particular circumstances associated with each case and identifies the opportunities to reduce injury in this multifaceted and changing context. Thus, the opportunity for SMARTRISK to provide a unique and valuable contribution to the already crowded fields of Safety, Risk Management and Injury Prevention is to continue its focus on the interactions between individuals and their environmental contexts.

For one example of a future direction for SMARTRISK within this perspective consider the intersection of sustainable development, population health and risk management. Here there are several points of contact with the SMARTRISK approach to injury prevention. The first is the connection between preventable injuries and their impact on a sustainable workforce. *The Economic Burden of Preventable Injury in Canada* suggests that the reduction of such injury would make a significant, if not the greatest, contribution to the sustainability of the working age young adult workforce at a time when there are fears about its future. The role of prevention rather than treatment is in general a significant component of social sustainability. And this area of sustainable development has been arguably the most difficult to translate into policy. Finding how injury prevention might play a larger role in policies that stress prevention would constitute a critical contribution to this thread of sustainability.

Finally, there are multiple connections between SMARTRISK and population health. The identification of how risk behaviour is concentrated differently in differing age groups, the relation of risk behaviour to development and the identification of strategies for reducing injury in particular population groups are consistent with a population health approach. A major area of research for the future is in the area of inequalities in injury. There has already been quite a lot of work identifying gradients of health and illness that follow the socio-economic status of populations. It would open up important new areas of injury prevention strategy if such gradients could also be identified for the risk of injury. So far, there has been little work on inequalities in injury.

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<sup>123</sup> Milton J. Terrel, *Safety and Health Management in the Nineties* (Van Nostrand Reinhold, 1995).

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