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IDENTIFICATION OF COUNTERMEASURES FOR UNSAFE DRIVING ACTIONS

Volume II: A Review of Selected Literature

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16. Abstract

Literature on decision-making and social control was reviewed to identify key principles of human behavior that have potential for reducing the incidence of speed-too-fast and other conscious and intentional unsafe driving actions (UDAs). The review was a part of a larger study to define UDAs in operational terms and to identify promising countermeasures for the UDAs. Other results of the study are reported in Volume I: Description and Analysis of Promising Countermeasures, and Volume II: A Definitional Study of Speeding, Following Too Closely, and Driving Left of Center.

The literature provides much support for the countermeasure strategies that focus on specific target groups with specific decision problems. Other strategies are also discussed, for example, using incentives and punishments, and implementing attitude-change techniques. Ways of applying these strategies at the secondary and tertiary levels of social control are discussed.

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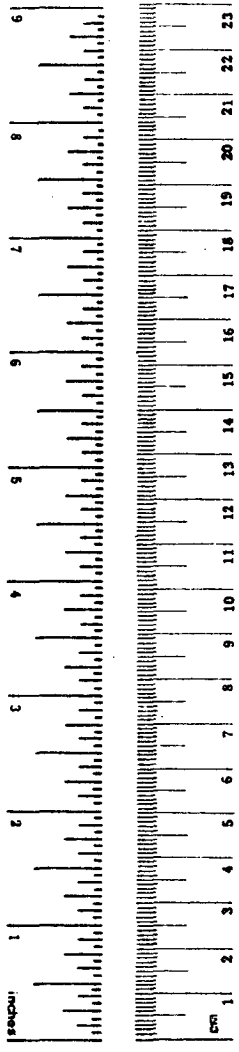
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

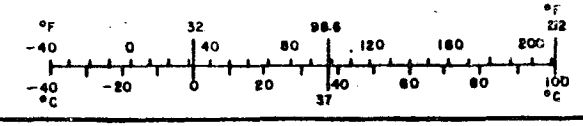
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.96	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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Maria E. Vegega was NHTSA's Contract Technical Manager for the project. Dr. Vegega provided many helpful suggestions on the structure and content of the report. Other NHTSA staff also provided useful comments. We appreciate their help.

CONTENTS

CHAPTER ONE
INTRODUCTION

This volume, a review of selected literature relevant to developing countermeasures against certain unsafe driving actions (UDAs), was prepared under National Highway Traffic Safety Administration (NHTSA) contract number DOT-HS-7-01797, entitled "Identification of General Deterrence Countermeasures for Unsafe Driving Actions." The review is one of three volumes reporting work conducted under this contract. The other reports are presented in "Volume I: Description and Analysis of Promising Countermeasures" and "Volume III: A Definitional Study of Speeding, Following Too Closely, and Driving Left of Center." The project was conducted by the staff of the Policy Analysis Division of The University of Michigan Highway Safety Research Institute.

This review deals only with literature in two broad subject matter areas, decision-making and social control. The reasons for this limitation are discussed later in this section.

Three UDAs were originally of concern in this project. They are:

- Speeding,
- Following too closely, and
- Driving left of center.

A definitional study (see Volume III) conducted jointly as a part of this project and two other NHTSA-sponsored projects (contract nos. DOT-HS-8-01827 and DOT-HS-8-02023) found that the first UDA (Speeding) was the most appropriate target for the type of countermeasures of interest in this project. Subsequent countermeasure development effort was directed at the speeding UDA and specifically at conscious and intentional commissions of this UDA.

OBJECTIVES

The general objective of the literature review was to identify and discuss literature on decision-making and social control relevant to the management of traffic crash risk created by the speeding UDA. Specific objectives were to:

- describe major theories and explanations that are useful in understanding the nature of risk and decisions that are made in managing risk,
- describe the basic concepts, principles, and mechanisms that relate to controlling driver behavior, and
- determine the implications of this material for developing and successfully operating countermeasures to reduce the incidence of the speeding UDA.

SCOPE AND APPROACH

This volume is a focused examination of those aspects of the behavioral sciences that appear to be the most directly related to the goals of this study. It is not intended as a comprehensive compendium of law, sociology, and psychology, nor is it a review of specific highway safety countermeasures.

The subject matter for this review is a logical consequence of the conceptual framework that was used in designing the project. A description of this framework is provided in Volume I of this report. Its essential elements are:

- the definition of an unsafe driving action as an act or omission by a driver that increases the risk of a traffic crash above a level that is societally tolerable,
- the identification of target UDAs for this project as those that are conscious and intentional,
- the precept that such target UDAs occur as the result of a rational decision-making process by the driver,
- the existence of social-control processes that attempt to influence driver decision-making about UDAs.

Thus, two major concerns in designing countermeasures to reduce the incidence of target UDAs are:

- how drivers make decisions about UDAs, and
- how these decisions can be influenced to produce a preferred outcome for society.

There is a body of literature that deals with each of these two areas. The literature on **decision-making** has its roots in the behavioral sciences and in mathematics. Its domain is the factors that influence human behavior and the way they interact in a given environment to produce a decision. The literature on **social control** flows primarily from law, sociology, psychology, and related disciplines (e.g., criminology). It is concerned with the nature and effects of control forces that are exerted on an individual by others with whom that individual interacts.

Clearly, both of these bodies of literature go far beyond the realm of highway safety. An exhaustive survey of all of this literature would be neither possible nor desirable for this project. Instead, there is a need to identify major theories, concepts, and principles to help stimulate the creation of countermeasure concepts based on a firm scientific foundation. This is the context within which this review was conducted.

This review was a part of a larger review conducted in concert with the police enforcement project. It supported the police enforcement project by providing a perspective on those aspects of social control involving the concept of deterrence that is missing in most of the literature on traffic law enforcement. The theoretical groundwork provided by this review also helped both projects in identifying highway safety applications of relevant principles and in assessing specific countermeasures and procedures gleaned from the highway safety literature. A full report of the part of the review that addressed specific procedures used by the police in enforcing related traffic laws was published as a separate volume under the police enforcement project (see Jones et al. 1980).

ORGANIZATION OF THIS VOLUME

This review is presented in three parts. First, literature relating to decision-making is discussed in Chapter Two. Included in this section is a discussion of classical and modern decision theory and of psychological and sociological factors that influence the application of the theory.

In Chapter Three, basic concepts of social control are discussed. The various levels of social control are defined, and related psychological and sociological theories are described. The mechanism of social control called deterrence or legal deterrence is also discussed in Chapter Three.

Chapter Four summarizes the findings and their implications for the study.

CHAPTER TWO
DRIVER DECISION-MAKING

The preceding chapter noted the critical role that decision-making plays in the highway safety process. The decisions individuals make with respect to risk determine the magnitude of the risk of traffic crashes and influence societal actions to reduce the crash risk to acceptable levels. To develop countermeasures to reduce traffic crash risk, it is necessary to understand how these decisions are made by individual system users, policymakers, risk managers, and society as a whole.

This chapter briefly reviews decision-making theory. It presents major theories and explanations that are useful in understanding traffic crash risk and the management of that risk.

DECIDING TO COMMIT A UDA

What is involved when a driver decides to commit a UDA? Joscelyn and Jones (1977) provide a departure point for answering the question. Their review describes how existing theories of human decision processes can be applied in managing traffic crash risk. A description of decision processes can be abstracted from the decision-making theories they discuss. Basically, all theories state that the decision-maker goes through six stages: (1) outlining alternative **actions;** (2) dividing the world into a set of possible future states, called **outcomes;** (3) assessing the **value** or **utility** of each outcome; (4) estimating **probabilities,** conditional upon each alternative action, of each outcome (i.e., for each alternative action, how likely it is that each possible future state will become the true state if that action is taken); (5) integrating the probability and utility information using one of a number of alternative schemes; and (6) comparing the integrated information with a criterion, which leads to a **decision.** The six hypothetical stages describe human decision-making.

A variety of theories and models extant in the social science

literature seek to explain the planned or conscious behavior of individuals and groups. Such theories attempt to describe and predict such behavior. Perhaps the best known of the theories of conscious behavior is found in the empirical and theoretical literature in the area known as decision theory.

Decision theory has its origins in the branch of mathematics known as probability theory. Questions posed in a decision-theory context stimulated advances in the mathematics of probability theory. So closely are these two fields allied that one can regard decision theory as a branch of applied probability theory.

Expected Value Theory

The first theory of decision-making was based on the concept of **expected values.** The theory originated to facilitate better decisions about gambling. It states, in effect, that a gambler faced with a decision about how to make bets on uncertain events with different payoffs should bet on the event that, on the average, maximizes his winnings. The expected value model may be formally specified as follows: a decision-maker must select one course of action out of a set of alternatives. Through some independent random process, a "state of the world" is determined or selected from a set of **all possible states.** The selection by the decision-maker of an alternative, followed by the occurrence, by random process, of a particular state of the world determines an "outcome," which can be represented as a monetary payoff (or loss) to the decision-maker. Further, it is assumed that the decision-maker **knows** the probabilities with which each of the possible states of the world can occur; the monetary values associated with each possible outcome; and the sets of possible courses of action and possible states of the world. The expected-value model of decision-maker will make a choice by computing the "expected value" or average return of each alternative available, and then select that alternative whose expected value is largest. This maximizing of expected value is referred to in decision theory as a **strategy.**

This model of "rational" decision-making, developed within the context

of gambling choices, was soon proposed as a theory of human decision-making. Under the prevailing belief that humans were essentially guided by reason and rationality, the **normative** (objective) expected value decision model was proposed, and for a time was accepted by some, as a descriptive model of human decision-making. Using this model, a **decision problem** is constructed when all alternative actions and outcomes are described in a relational structure. Decision trees (see, e.g., Raiffa 1969) represent decision problems. Figure 2-1 is an example of a decision tree for the decision problems described below. The asterisk represents the whole decision problem; boxes represent actions; circles represent outcomes. The links represent relational paths between actions and outcomes.

The following is an example of the construction and solution of a decision problem: A man begins a 350-mile return trip to his home. He travels on the interstate highway system. An expected-value decision theory indicates he would go through six stages in choosing what speed to maintain with his cruise control:

a) Outlining the alternative actions, he remembers the late 1960s and early 1970s when the speed limit was higher. He also remembers the speed limit is now 55. So, he develops two alternative actions, A_1, and A_2:

A_1: Cruise at 55 A_2: Cruise at 70

b) He imagines four possible future states (O_1 -O_4) establishing outcomes:

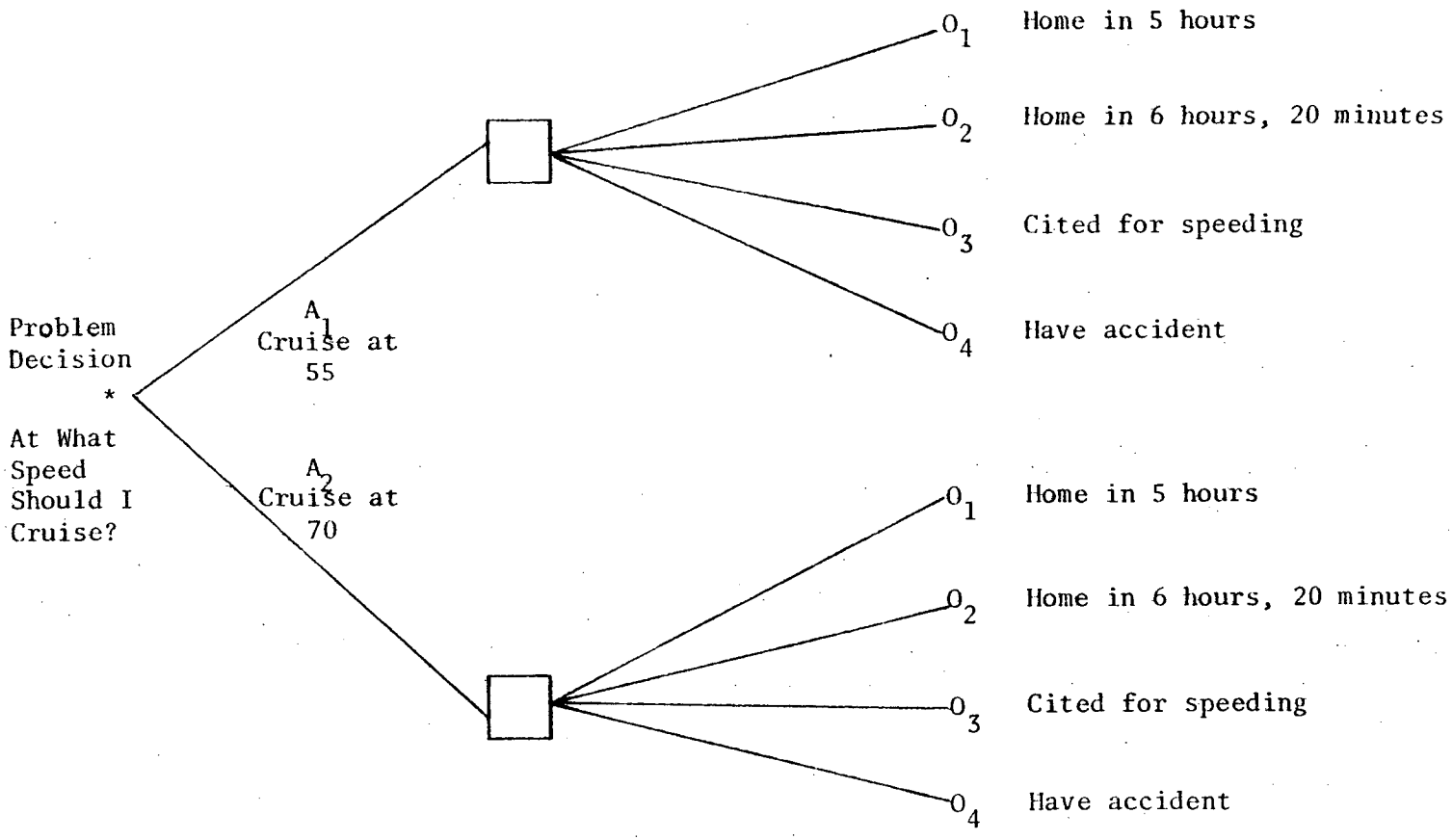
O_1: Be home without incident in 5 hours;
O_2: Be home without incident in 6 hours, 20 minutes;
O_3: Be cited for speeding; or
O_4: Have an accident because of the chosen cruising speed.

c) He next assigns utilities to each of the outcomes. Dollar values will be used here. The following matrix describes his

FIGURE 2-1

DECISION TREE FOR EXAMPLE

DECISION PROBLEM



utility assignment.

Outcome:	O_1	O_2	O_3	O_4
Utility:	\$600	\$450	\$-100	\$-10,000

d) He estimates the probabilities of the outcomes, conditional upon each alternative action. Table 2-1 represents the driver's probability assessments:

TABLE 2-1

PROBABILITY ASSESSMENTS FOR EXAMPLE DECISION PROBLEM

	OUTCOME			
	O_1 (Arrive in 5 hours)	O_2 (Arrive in 6 hours, 20 minutes)	O_3 (Citation)	O_4 (Traffic Crash)
Action:				
A_1 (55 mph)	0.0	.99999	0.0	.00001
A_2 (70 mph)	.99998	0.0	.00001	.00001

e) The driver uses matrix multiplication to integrate probability and utility information. He multiplies the probabilities and utilities and then adds the products to get the expected value (see Edwards 1954) for each alternative course of action. For A_1 (cruise at 55) the expected value is \$449.90; for A_2 (cruise at 70) the expected value is \$599.89.

f) The driver's criterion is to select the alternative action with the maximum utility. He then sets the cruise control at 70 and drives on. He decides to commit the speeding UDA.

The above described example is, of course, greatly oversimplified. A

350-mile trip consists of many decisions regarding speed, and these decisions depend on many other factors, such as the presence of enforcement symbols, CB radio messages, road and weather conditions, and the speed of other traffic. Nevertheless, this example does illustrate the expected-value decision-making model.

As with other models and theories of human behavior, it was not long before experimental investigations indicated that human decision-makers did not in fact comply with the predictions of behavior generated by the expected value model. For example, instances could be constructed in which most persons would prefer certain choices with lower expected value over those with higher expected value. Thus, it was evident that human decision-makers were responding to aspects and dimensions of decision-making situations that went beyond the mere computation of probabilities and monetary payoffs.

Utility Theory

Upon the failure of expected value theory to adequately describe the decision-making behavior of actual decision-makers, the theory was modified by introduction of the concept of "utility." Without going into the technical and mathematical properties of utility theory it is sufficient here to define it as an index of an individual's personal or subjective preference for an outcome, object, or event. By replacing the objectively defined concept of "value" (measured in monetary units) with the subjectively defined concept of "utility," it was hoped that the rationality assumption of human decision-making could be retained by the simple expedient of proposing that individuals are guided in their decision-making by those choices that maximize expected **utility** rather than expected **value**.

Though expected utility theory fared better than expected value in explaining and predicting the choice behavior of human subjects, the revised model was not able to adequately explain the anonalous experimental results that continued to be produced. For example, certain choice situations could be constructed in which subjects consistently preferred an alternative that provided lesser expected utility. Again, the

data indicated that the dimensions of decision-making were more numerous and complex than those of the explanatory model.

Scientific controversy now centers around whether humans are "rational" or "irrational" in making decisions. The "irrational" label has often been applied to decision-making that does not follow the expected value or expected utility theory. Simon (1957) has resolved the controversy with his theory of "bounded rationality." Because of humans' cognitive limitations, Simon indicates that humans must deal with the world through simplified "models." He argues:

> . . . (the decision-maker) behaves rationally with respect to this (simplified) model, and such behavior is not even approximately optimal with respect to the real world (or to prescriptive decision processes). To predict his behavior, we must understand the way in which this simplified model is constructed, and its construction will certainly be related to his psychological properties as a perceiving, thinking, and learning animal. (p. 198)

Thus we assume that drivers make decisions that are rational with respect to a bounded, internal **world-model.**

Recent reviews of decision-making (e.g., Slovic, Fischhoff, and Lichtenstein 1977) indicate the utility assessment stage most likely involves the most conscious mental activity. Private decision-makers show great concern about their own welfare. They focus much attention on identifying what outcomes produce a "payoff" in their world-model and tend to disregard other factors, such as the actions they must take to obtain the outcome, or the probabilities of the outcome.

Private world-models determine what payoffs will be assigned to outcomes (see, e.g., Slovic, Fischhoff and Lichtenstein 1977). World-models include perceptions, personal values, and attitudes, which are discussed below. In assessing the utility and disutility of outcomes, the private decision-maker follows a course consistent with the values, desires, and needs dictated by his or her world-model. In our earlier example the driver valued time at home at $120 per hour. Assuming outcome O_1 affords the driver five hours at home, it is worth $600 to him; outcome O_2 that provides only 3 2/3 hours at home, is worth

roughly $450. Other drivers would value time at home differently, but still according to their world-models.

Two questions now arise: (1) What utilities and disutilities do drivers assign to driving outcomes? and 2) How accurate do the assignments seem with respect to the "free market?"

No information exists about driver disutility assignments. We do not know what value drivers place on disutility producers such as sanctions, collisions, injuries, or fatalities. Devoid of data, we are left with speculation.

In general, it has been substantiated that drivers assign a large positive utility to fulfilling personal transportation needs through driving their own car (Finkelstein and McGuire 1971). Furthermore, the psychometric analysis of Fischhoff et al. (1976) shows that people perceive large societal benefits stemming from their use of motor vehicles. Clear evidence exists that drivers perceive a large utility from the safe use of their motor vehicles; however, no data exist that pertain to specific outcomes. For our example driver, no hard data exist about assigning payoffs to outcomes. Though we can infer from the general level data that most drivers assign large utilities to outcomes involving safe travel, the data are not specific enough to lend great confidence to such inferences. A thorough analysis of driver decision-making requires the development of distributional norms for the utilities (and disutilities) assigned to specific outcomes. The current lack of such norms constitutes a significant knowledge gap.

In the face of this gap, we can only speculate about the values assigned to driving outcomes and their accuracy. With respect to decision problems about whether to drive unsafely, Edwards (1968) suggested that drivers overestimate the utility of unsafe driving, are not even concerned with the utility of safe driving, and underestimate the disutility of accident involvement. From this viewpoint, UDAs result because of both the drivers' overestimation of their utility and underestimation of their potential disutility.

A point related to Edwards' assessment is that risk may be perceived as a utility itself. Certain drivers may find a large positive utility from

treating driving as a "gamble." They prefer the thrill of accepting accident risk to the humdrum of driving safely (see, e.g., Andriessen 1972). The thrill of "flirting with death" is very valuable, and likely provides some drivers with a strong motivation to commit a UDA.

Overall, sufficient data do not exist to rigorously describe how utility and disutility values are assigned to driving outcomes. This lack of data prevents us from determining (a) how accurate drivers are at utility assignments, and (b) whether drivers' utility/disutility assignments lead them to commit UDAs, as Edwards suggests. These questions cannot be answered at this time.

Still, values and payoffs probably dominate a driver's conscious reasoning when deciding whether to commit a UDA. This suggests that private utility assessment is an area at which a risk-management strategy should be directed. We will now review what might be done to change drivers' utility assessments.

Subjective Probability

The next step in refining the rational theory of decision-making was to propose that the objectively defined **probabilities** of previous models be replaced by what might be called "subjective probabilities." In a subjective-probability model, individuals, in their decision-making, deal in probabilities in a **personal** way, judging likelihoods in ways that well might differ from some objectively defined standard. People could be expected to make their decisions upon the basis of their own personal and subjective feelings about probabilities, rather than upon some externally defined measure of likelihood. Further, this modification in decision theory allowed for individual variation in choice behavior and decision-making. It was therefore possible, under subjective-probability theory, for two decision-makers with identical preferences for outcomes to be both "rational" and arrive at different decisions simply because they differed in their appraisal of the probabilities of various outcomes. This concept of subjective probability originated long before decision theory was defined as a separate discipline, but was not incorporated into decision theory until fairly recently.

Ideally, a review of driver probability estimation would answer two questions: (1) how drivers make the estimates (i.e., what reasoning processes do they employ), and (2) how well drivers estimate the risk and probabilities (i.e., whether their estimates reflect the actual likelihoods).

The currently favored theories of probability and risk estimation claim that **heuristics** are used. A heuristic is a plan or approach for solving a problem. It provides guidance, but does not guarantee that a solution will be reached, or, if reached, that the solution will be accurate. Heuristics are best thought of as parts of people's world-models. They allow people to use their limited cognitive capacities to deal with very complex, real-world situations by reducing the amount of "mental effort" required to make judgments. To make judgments easier, many heuristics lead the decision-maker to ignore hard-to-obtain, but critical, real-world data and substitute nondiagnostic private world-model surrogates that are easily brought to mind. Because critical information is ignored, heuristics lead decision-makers to perform more or less "irrationally" with respect to objective probability data.

Tversky and Kahneman (1971) identified heuristics that can play a large role in probability and risk estimation. One heuristic is pertinent here. Drivers employ the **availability heuristic** when they judge the probability or risk of an event by the ease with which instances of the event can be brought to mind. Consequently, when estimating traffic-crash risk, people are greatly influenced by the relative ease with which they can remember traffic crashes. The availability heuristic therefore involves the conscious process of bringing instances of events (e.g., accidents) to mind, but not a conscious attempt to judge how likely the event will occur. Drivers who use the availability heuristic do not consciously think about the **probabilities** and the risks of outcomes; instead, they think only about the **outcomes** themselves, devoid of probability and risk.

Fischhoff et al. (1976) used the availability heuristic to explain the results they obtained when people estimated the risk of death in a motor vehicle crash. People tend to overestimate this risk in comparison to the risk of death from other causes, for example, from disease. This makes sense in light of the availability heuristic, as traffic accidents are given

intense and often spectacular media coverage. Media pictures are very salient in a driver's mind, so drivers easily remember them when estimating traffic crash risk.

Joscelyn and Jones (1972) surveyed drivers of Fairfax County, Virginia. One question allowed drivers to estimate their risk of apprehension for violating traffic laws. Over one-half of all respondents estimated the risk as greater than .22. Since the actual risk of apprehension is far less than this, most drivers grossly overestimated the risk. One reason for this could be the availability heuristic: traffic stops are easily pictured in the driver's mind and are therefore perceived as more likely than they really are. Other reasons can be identified with learning theory, and these are discussed below.

No specific data exist about how and how well drivers estimate the probabilities of **not** having a crash or **not** receiving a citation. The partial information available in the literature suggests that drivers will tend to overestimate the risk of a disutility-producing outcome (either an accident or a citation) because they vividly remember (or can imagine) both accidents and citations and employ the availability heuristic. Overestimation will occur regardless of the presence or absence of a UDA. By a similar argument, drivers will tend to **underestimate** the probability that no incident will occur; drivers will have difficulty remembering or imagining the no-incident situation because such situations have relatively less salience in a person's memory. However, this conjecture is a hypothesis requiring experimental verification. Another hypothesis might be that the repeated occurrence of no-incident trips is reinforcing, resulting in an overestimation of the probability of no incident (This is treated in greater detail in the discussion of learning processes in the next subsection).

The literature on the accuracy of private probability estimation repeatedly points to one conclusion: people are poor at estimating risk and probability (see, e.g., Slovic, Fischhoff, and Lichtenstein 1977). A number of reasons have been proposed. **People do not understand probability** because it is a complex concept (Slovic, Fischhoff, and Lichtenstein 1977, 1976). Because people do not understand probabilistic

relationships and processes, **they use erroneous heuristics** in probability estimation (Kahneman and Tversky 1977; Kaplan and Newman 1966). The availability heuristic implies that **drivers do not focus upon the probability and risk of outcomes**, but instead focus on the outcomes **per se**. More generally, **people do not use all the information they have** when judging uncertainty (Edwards 1968).

In their limited world-models, people do not consciously deal with probabilities and risks; instead they deal with outcomes. Even with sophisticated statistical training, scientists make inaccurate probability estimates, and do not employ appropriate statistical procedures (Tversky and Kahneman 1971). Thus, attempting to change driver behavior by changing risk estimation is likely to fail.

Not only are humans unskilled at handling probabilistic concepts, but the difficulty of dealing with risk **per se** is compounded by the fact that the traffic-crash risk is very small. In any individual's life, a traffic crash is a rare event. People make more errors in estimating extreme probabilities (those near zero or one—Phillips and Edwards [1966]); indeed, the distinction between one in N events and one in 10 or 100 times N events becomes obscure and remote when N reaches the millions and billions. In general, decision-makers deal poorly with very small risks. So, even if drivers were easily to grasp the concept of risk, traffic-crash risk would produce difficulty because on any given trip it is so small.

Prevention of accidents is an example of what psychologists call a **vigilance task.** A vigilance task attempts to prevent low probability but highly costly outcomes from occurring. A serious injury in a traffic crash is an example of such an outcome. In general, people are very poor at performing vigilance tasks due to suboptimal resource allocation. In plain terms, people tend either to be overly concerned with the large possible loss and expend more effort and resources than are warranted on accident prevention; or take the attitude that "it won't happen to me" and completely ignore the possibility of an accident, meaning no caution is exercised. Slovic's (1978) data and analyses also support this viewpoint. If not given any guidance, most people will be very suboptimal in allocating resources for accident prevention. Thus, risk managers must

include specific directions about how caution should be exercised in driving, so that people act optimally to prevent accidents.

SOCIAL AND PSYCHOLOGICAL FACTORS IN DECISION-MAKING

What has evolved is essentially a **psychological** theory of decision-making, rather than a truly "rational" theory. With the abandonment of the index of monetary value to appraise the worth of alternatives, and the replacement of objectively defined probabilities with personal or subjective ones, the burden of understanding and predicting the decision-making behavior of individuals and groups has shifted from mathematicians and decision theorists to social and behavioral scientists. That actual human decision-makers do not conform to neat rational models of decision-making has become obvious. To understand how decisions are made, attention must now be directed to the social and psychological factors that affect human decision-makers.

Along with the realization that formal and "rational" models of decision-making are inadequate as descriptive theories of actual decision-making, it has begun to be accepted that social factors also play an important role in the behavior of decision-makers. The individual is part of a social and institutional structure that tends to shape perceptions and values in systematic ways. Thus, to understand and predict the decision-making process, one must also study the social milieu in which it takes place. An adequate theory of decision-making, unlike theories of the past, must consider the influences of societal factors upon individual and group decision-makers.

Learning Processes and Decision-Making

Knowledge of human behavior gleaned from other areas of the behavioral sciences can be of great help in understanding the underlying psychological and societal factors that affect human decision processes. One area deserving further study is the manner in which fundamental principles of the human learning process interact with personal bias and place constraints upon decision-making. Although it appears obvious that a decision-maker is also a "learner," there is little in the empirical or

experimental literature that deals with changes in behavior during the decision-making process.

Traditional models of decision-making typically conceptualize the world as made up of statistically independent events, and hence have relied upon mathematics that assumes them to be independent. Behavioral scientists, however, recognize that there is a marked statistical dependency in real-world events that is often mirrored in the laws describing human behavior. **Unlike ideal decision-makers, human decision-makers are affected in their perception of the present by experiencing the consequences of their past decisions.** In some situations this may be appropriate, as when the fisherman who was successful at a particular bend in the river in the past returns there in the expectation of again being successful. In other situations, however, this very "human" characteristic works to the detriment of decision-makers, as when the gambler, having experienced a string of losses at roulette, makes larger wagers, falsely reasoning that the probability of a win must have been increased by the past losses. To adequately understand the dynamics of decision-making, the natural propensities of humans to perceive the world in a particular manner and the plasticity of behavior subject to past events or "reinforcers" must be incorporated in theoretical formulations.

While we know very little about how humans construct decision problems, **per se**, we do know some things about how humans construct the relational structures for general problems. Recent research at Carnegie-Mellon University (Simon 1975), and The University of Michigan (Greeno 1972) indicates that an individual's "decision tree" reflects primarily (a) what the decision-maker remembers from setting up previous and similar decision problems; and (b) what the decision-maker perceives from the immediate decision situation.

What a driver remembers and perceives controls the establishment of alternative driving acts and outcomes. A decision-maker's world-model affects perception and memory processes. The "rationality" of a driver's decision is determined in part by the match between the construction of the decision problem by the driver and the construction that risk

managers think should be employed. Since world-models are idiosyncratic, great individual differences exist in the decision problems constructed by individuals. What appears to be an irrational and unsafe driving behavior to the risk manager may actually be based on alternatives that the driver considers sound and wise.

Since memory and perception are private processes, they lead one driver, or one group of drivers, to construct radically different decision problems from other drivers or groups. The differences can be very significant. For example, Klein (1972) has pointed out that some teen-age youth often regard a vehicle more as a bar or motel than as a means of transportation. Therefore, the driving decision problems they formulate are radically different, for example, from those of people in their fifties. These teen-agers do not think of transportation factors; instead, they construct decision problems about recreation factors.

Recency and Time Delay

Another important aspect of human behavior that plays a part in the decision-making process relates to the dimension of **recency.**

The recency phenomenon, well established through experimental studies, plays an important role in the learning process. According to some learning theorists, learning takes place when the consequences of various behavioral acts provide "feedback" to the individual in the form of rewards and punishments. Behaviors that produce consequences rewarding to the individual have an increased probability of a future occurrence, while behaviors that produce punishing consequences have a lessened probability of future occurrence. Through this "reinforcing" mechanism the consequences of various behaviors serve to strengthen certain behaviors while eliminating others.

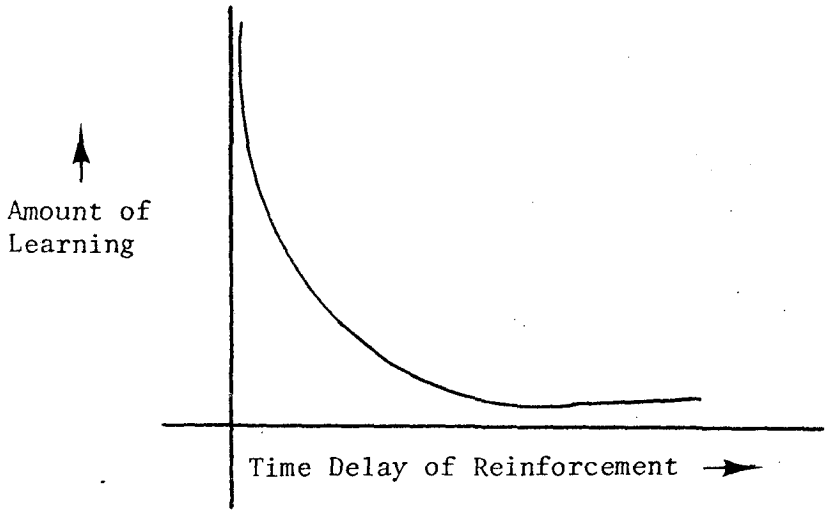
Put simply, the recency effect means that the amount of learning produced by a reward or punishment will depend upon the time delay between the behavior that produced it and its consequences to the actor. Thus, when there is a long delay between behavior and consequent rewards and punishments, the consequences do little to alter behavior; when the delays are minimal, rewards and punishments have their greatest

impact upon learning. Graphically, the relationship between time delay and amount of learning resembles that shown in Figure 2-2.

This fundamental principle of human learning has profound effects upon how persons make decisions. It follows from this principle, for example, that individuals will tend to underestimate and thus undervalue the impact of future events, and correspondingly overvalue the **immediate** consequences of their behaviors. This very human sort of bias is reflected in such sayings as "A bird in the hand is worth two in the bush," or "Let us eat and drink; for tomorrow we shall die."

FIGURE 2-2

THE RECENCY PHENOMENON



In some instances of decision-making, this sort of bias may not be harmful; to a certain degree it may be justified, in the economist's words, to "discount" the future. However, there are a number of situations in which this aspect of human nature leads decision-makers to seek immediate gains at the expense of objectively more desirable long-range gains. In other words, the recency effect may lead a decision-maker, in evaluating alternatives, to overestimate the value of immediate rewards and underestimate the value of delayed rewards. The same is true with

respect to punishments; the immediate ones are overvalued, the delayed ones undervalued. For example, the immediate discomfort or inconvenience of wearing a seat belt may lead some people not to use them, but increases the probability that they will suffer much more severe consequences (such as death or serious injury) in the future. Only after a crash has occurred, and the injury is an immediate event rather than a remote one, does one regret not wearing a seat belt.

Bias in decision-making caused by the recency phenomenon can have especially deleterious effects when a particular behavior produces a mixture of consequences, such as an immediate small reward and a delayed but severe punishment. In this instance the time-delay effect may well lead the decision-maker to ignore the future punishment in his preference for immediate gain or reward. For example, a decision to drive after drinking too much alcohol produces an immediate reward in the form of readily available transportation, but increases the risk of a future crash or arrest and its accompanying "punishment."

Perception of Risk and Probability

In the preceding discussion of the time-delay effect, attention was directed toward a cognitive process that, in decision-making language, affects one's subjective evaluation of outcomes. There it was stated that the decision-making models used to describe choice behavior are composed of two classes of variables: those dealing with **outcomes** and their evaluation by the decision-maker, and those involved with the appraisal of **probabilities**, likelihoods, and risk. Behavioral science can contribute a great deal to our understanding of both classes of variables.

As stated earlier, human beings are not very skilled at estimating probability, and their difficulty with this concept is exacerbated by the relative rarity of traffic crashes or citations. This would be so even if human beings functioned independently and entirely apart from others, which of course is not the case. In the probability or risk-appraisal dimension of the decision-making process, one deals primarily with a perceptual and cognitive aspect of behavior. In this aspect of human behavior, there is a complex interaction among physiological, social, and

environmental factors. It is almost a truism to say, from a perceptual standpoint, that "objective" reality exists only as an idealized state.

For example, studies conducted in the social psychological laboratory have shown that an individual's perception of so simple an event as the movement of a light source in a darkened room is greatly affected by prior reports of movement made by other persons who were also there (Sherif 1936). Similarly, the observer's motivational states and preexisting attitudes and beliefs can greatly affect the perception of a situation; for example, hungry persons tend to see food items in the ambiguous perceptual field of a Rorschach card. Everyone is also familiar with the phenomenon captured in the folk wisdom of the proverb, "The grass is always greener on the other side of the fence," or Aesop's fable of the "sour grapes." In each of these examples the individual's perception of particular events or states of the world is affected by the probability of achieving a sought-after outcome. (The proverb and the fable constitute competing "theories" of behavior; the former predicts that unattainable outcomes are **enhanced** in attractiveness, while the latter predicts that humans deal with their setbacks by minimizing them.)

Several other behavioral phenomena that can bias humans' appraisal of "reality" have been discovered in the psychological laboratory but have not yet been integrated into theories of decison-making. For example, it has been established that individuals, when shown a random sequence of binary events (such as a string of red and blue lights), almost invariably report detecting a "pattern." That is, people automatically attempt to find and impose an orderly rule or explanation for observed phenomena or an event even when, in a statistical sense, such order is absent. A converse effect has also been observed. Subjects in a psychological experiment have been asked to attempt to generate a random sequence of events--for example, to simulate the behavior of a fair coin and state the outcomes of 100 hypothetical flips of the coin. However, when these humanly generated "random" events were analyzed by statistical tests of randomness, they are almost invariably found to be highly **nonrandom**--that is, very different from what would be generated by a truly random device. These two aspects of the human response to

randomness have significant implications for the study and modeling of human risk behavior. What they imply is that humans deal quite poorly with random events because they **do not recognize** randomness when they see it, and what they do perceive as random is generally in fact not random. These aspects of the human perceptual process cannot but influence the decision-making process by introducing systematic bias and, as a result, less than optimal performance.

Another very human foible that affects individual decision-makers when they deal with probabilities is their susceptibility to selective distortions of memory when evaluating their own prior performances. This has been demonstrated in studies in which subjects are asked to give estimates of the probability that particular future events will occur. Some weeks or months later, the subjects are brought back and some are informed that those particular events had in fact occurred, while others were told the same events had not. Each group of subjects is then asked to **recall** their previous probability estimations. Subjects who were told the events **had** occurred "recalled" larger probability estimations than they had actually made; those who were told the events **had not** occurred "recalled" smaller estimations than they had actually made. This "hindsight" effect is not surprising to observers of human behavior. Persons are prone to recall the past in ways that enhance their self-esteem. Thus, when one relies upon the past to provide information and lessons as the base for present or future decisions, the "hindsight" effect can bias his or her estimations, causing the decision-making to be less than optimal.

Most individuals have this "hindsight" bias partly because humans generally misunderstand and misapply the concept of probability. Although most persons have an "intuitive" theory of probability, in many cases their intuitions vary so much from objective theory that the performance of untrained individuals in probability estimation tasks falls far below optimal levels. For example, when humans were asked to estimate the probability of alternative hypotheses, based upon samples of data that pertain to those hypotheses, the subjects were less able to make optimal use of that probabilistic data than statistical

decision-making models were able to do. In such situations, people generally tend to be "conservative"; that is, they change their estimates of probabilities at a slower rate than is called for by the available evidence. Put another way, human decision-makers, at least untrained ones, do not make full use of all the information available to them in estimating probabilities.

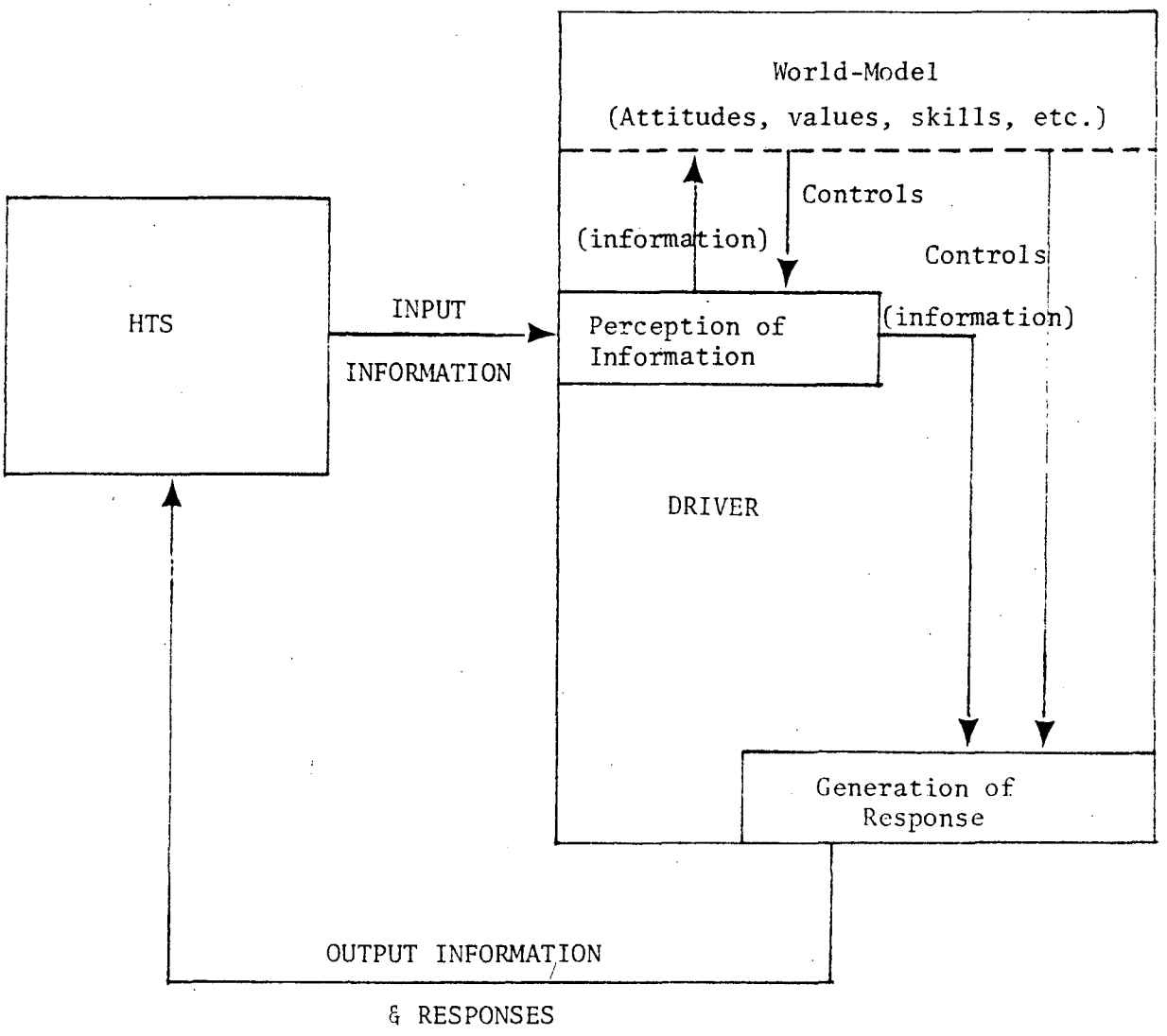
Individual Attitudes and Values

Psychological theory states that **attitudes and values** are included in everyone's world-model. Furthermore, attitudes and values determine how and what payoffs will be assigned to outcomes. Attitude and value theory indicate that there are at least two sources of influence for shaping a driver's utililty assessments. The first source of influence is **social norms.** Wilde (1976) and Shor (1964) have analyzed the effect of social norms on driver decision-making; their analyses indicate a great effect exists. Social norms are discussed in greater detail in the social-control materials in Chapter Three. **Internalized attitudes and values** comprise the second source of influence on the driver's decisions. Attitudes and values are important components of every individual world-model. In considering how drivers might be dissuaded from committing UDAs through changing their attitudes and values, several possible approaches are available. All of these approaches assume a model of driver behavior similar to the one illustrated in Figure 2-3. The left box in that figure represents the Highway Transportation System (HTS) without drivers. The HTS provides a driver, represented by the right box, with input. Other HTS components include vehicles, highways, and elements that support their operation (e.g., fuel supplires, vehicle manufacturers, and highway construction firms). The driver's world-model, through remembered attitudes, values, and skills, controls his or her perception and response to HTS input. Attitudes and values play an integral role in those functions. Driver behavior is the response to HTS input and that response in turn serves as input to the HTS.

Figure 2-3 illustrates that driver decision-making can be changed either by rearranging the input that is received by the driver, or by

FIGURE 2-3

BLOCK DIAGRAM ILLUSTRATING INFORMATION
INTERPRETATION OF THE HTS



changing how the driver processes input. In the former case, drivers' world models are not tampered with; instead, external payoffs are changed so that the existing attitudes and values of the driver lead to the desired behavior. Scientists refer to the approach of rearranging input as the "external incentives" approach. Several types of external incentives are used to influence behavior. **Economic incentives** often induce people to behave appropriately, and **social approval incentives** also motivate a great number of behaviors.

People often pattern or **model** their behavior after others whom they admire. In the case of modeling, attempts are made to alter input processing by changing drivers' world-models. Since attitudes and values are often the focus of these change efforts, the approach of rearranging world-models is referred to as the "attitude change" approach. That approach uses a number of means to change attitudes. Some means have been formalized into a technology called "persuasive communications." Persuasive communications covers a broad variety of methods, and applies to many traffic safety problems.

Driver Impairment and Decision-Making

Factors more transient than social norms or attitudes and values also influence driver decision-making. An individual's physical and mental state can affect behavior and factors that alter these states can enhance or impair driving performance. Among these factors are disease and other conditions (such as fatigue, anxiety, depression, and epilepsy) as well as chemical agents such as alcohol and other drugs. For example, psychoactive drugs (including alcohol) interact with brain functions and thus can heavily influence the decision-making process of drivers. Such chemicals can affect an individual's ability both to receive information and to process it. For example, alcohol has been shown to degrade almost everyone's visual acuity at the higher blood alcohol concentrations (Newman and Fletcher 1941). A person's ability to concentrate on driving-related tasks also is impaired by alcohol (see, for example, Moskowitz [1974]).

The literature is replete with examples of the impairing affects of

alcohol on more complex functions of the nervous system such as are involved in decision-making. Some research suggests that many individuals are more likely to engage in risk-taking after drinking (Cutter, Green, and Harford 1973; Goodwin, Powell, and Stein 1973; Wallgren and Barry 1970). However, the mechanisms responsible for this behavior are not well understood. For example, it is not known whether impaired ability to perceive risk or impaired ability to process risk information is more responsible for increased risk-taking at higher blood alcohol concentrations. Certainly, alcohol does adversely affect both short-term and long-term memory (Ehrensing et al. 1970; Wallgren and Barry 1970) and would thus be expected to alter a driver's assessment of driving outcomes by degrading the information available for making decisions.

Among substances that can impair driving ability, alcohol is both unique and much studied. Alcohol—its actions and effects--is often used as a reference point in considering the potential of other drugs to increase highway safety risk. Yet drugs other than general central nervous system depressants (of which alcohol is one) differ greatly in their actions on the brain and in their effects on behavior. Agents that primarily influence mood, such as tranquilizers and antidepressants, or sensory perception, such as hallucinogens, are well known but little studied in relation to driver decision-making. Marijuana, which may be said to have both depressant and stimulant properties, appears to influence cognitive functions such as perception and information processing. Some research has indicated that subjects given doses of marijuana are less inclined to engage in risk-taking behavior (Rafaelson et al. 1973; Dott 1972). Whether this results from a shift in decision-making criteria, an enhanced perception of risk, or reflects compensation for a self-perceived impairment due to the drug cannot be determined from existing data. What is evident is that different drugs can influence decision-making behavior differently.

Thus, it is clear that the decision models described in the preceding sections of this chapter do not apply uniformly to impaired drivers. Such drivers may be expected to differ from other drivers both in their selection and use of decision-making models.

UNCONSCIOUS DECISION-MAKING

Another issue in driver decision-making is whether the commission of a UDA is **conscious** or **unconscious.** Consciously committing a UDA involves a reasoned and deliberate intent to drive in a risky manner, for example, speeding to arrive at one's destination in a shorter time. Unconsciously committing a UDA implies the lack of a reasoned and deliberate intent to drive in that manner, for example, speeding because a driver selects a speed according to the flow of traffic and consequently does not realize how fast he or she is driving.

The conscious/unconscious distinction theoretically would divide UDAs into two categories. Although characterizing a driving act as "conscious" or "unconscious" is not relevant for the purposes of **defining and measuring** UDAs, this theoretical distinction provides important information for examining driver **decisions to commit** UDAs. Drivers engage in fundamentally different thought processes for conscious UDAs than for unconscious UDAs. Consciously committing a UDA implies the driver follows a series of decision steps, weighs factors, and decides. Unconsciously committing a UDA implies the driver does not follow the decision steps, but instead acts through well-established and automatic habit. Some habitual driver behaviors may be amenable to external manipulation using some of the social-control approaches described in the next section.

Whether a UDA is conscious or unconscious makes a difference in what countermeasures can be developed to reduce its incidence. If drivers consciously commit a UDA, countermeasures should aim at altering drivers' decision processes so that they are less likely to commit them. If drivers unconsciously commit a UDA, countermeasures must not only both bring the commission of that act under conscious control, but must also, if necessary, alter the drivers' conscious decision processes. Changing decision processes requires an extensive and complex risk-management strategy, which probably requires a great expense of time and money. Thus, decision-making analysis must not only recognize the distinction between consciously and unconsciously committing a UDA,

but also must identify the most economical countermeasure design features necessary to reduce the incidence of UDAs. Note, however, that the focus of this study is on conscious UDAs resulting from driver decisions; consequently, these materials will discuss conscious decision-making in detail.

As stated earlier, a driver who outlines alternative outcomes establishes a decision problem in his or her mind. When the decision-maker does not describe alternative outcomes, then meaningful utility assignment and probability estimation are impossible. In the latter case the driver does not consider the real-world information existing at the time of driving but instead acts from an internalized "script." For example, a person who drives fast because he imitates the way Burt Reynolds drives in the movies is such a script follower.

Drivers who act from internalized scripts will likely not respond to the same types of countermeasures that would be effective for those who integrate real-world information. Acting from a script requires little thought and conscious activity. Script followers "blindly" act them out and ignore real-world information that is found important by decision-makers who integrate information. Like well-established habits, scripts alone determine behavior. Very little in the immediate driving environment can therefore effectively change a script-follower's behavior. Thus, *countermeasures directed at script-followers must change the* internalized script itself to effectively change behavior.

OTHER DECISION-MAKING MODELS

The fully rational decision-making model, and the unconscious decision-making process, in a sense represent the opposite poles of driver decision-making. Between these extremes are a number of processes in which the decision-maker considers some elements of the problem presented, but rejects other, equally important elements.

A decision-maker's world-model limits the information-integration scheme that is used. Limitations come from both forward and backward directions in the decision process. Decision-making stages that occur prior to the information integration stage impose **forward** limitations.

For example, if a decision-maker's world-model does not include a working concept of probability, then no probability or risk information will be available for integration. The final decision (criterion-comparison) stage imposes **backward** limitations. For example, if a decision-maker's world-model prescribes choosing only outcomes that can lead to the largest utility (regardless of their risks and probabilities), choice requires only utility information.

Alternative information-integration schemes have been investigated in psychological experiments (see, Slovic, Fischhoff and Lichtenstein [1977] for a review). These alternatives fall into four categories, which are summarized in Table 2-2. **Combination-analysis information-integration schemes** are similar to the decision-making example that appeared earlier in this Chapter. These filter out neither probability nor utility information. **Aspect-analysis information-integration schemes** filter out probability information and amplify utility information. **Probability analysis information-integration schemes** amplify probability information and filter out utility information. **Script information-integration schemes** ignore both probability and utility information.

In plain terms, the combination-analysis decision-maker pays attention to both utilities and probabilities; the aspect-analysis decision-maker pays close attention to utilities and ignores probabilities; the probability-analysis decision-maker ignores utilities and pays close attention to probabilities and risks; and the script decision-maker pays no attention to the utilities and probabilities involved and merely acts from a memorized script.

Thus, a driver who selects a driving speed that would maximize expected value uses a combination information-integration scheme. A driver who speeds because time spent at home is valued more highly than time spent on the road uses an aspect-analysis information-integration scheme. The driver who speeds for thrills uses a probability analysis information-integration scheme to maximize expected value. Finally, a driver who mimics Burt Reynolds' driving uses a script information-integration scheme.

TABLE 2-2

ALTERNATIVE INFORMATION-INTEGRATION SCHEMES

CATEGORY OF INFORMATION INTEGRATION SCHEME	DESCRIPTION
Aspect Analysis	In aspect-analysis schemes, probability and risk information is ignored or deemphasized. Decisions are based primarily on the subjective **utility** of outcomes. The information-integration scheme issued to order outcomes by their associated utility.
Probability Analysis	In probability analysis schemes, utility information is ignored or deemphasized. Decisions are based primarily on the **probability** of outcomes. The information-integration scheme is used to order outcomes by their probability of occurrence.
Combination (Aspect and Probability) Analysis	In combination-analysis schemes, **both probability and utility** information are considered, and underpin decision. The information-integration scheme is used to order outcomes with a bivariate function of their probability/risk.
Script	In script schemes, all information from the world is deemphasized. The decision-maker follows a coherent script that (s)he has memorized. The decision-maker "blindly" plays a role much like a movie actor follows a script.

SUMMARY

The theory of human decision processes has evolved to a point where the underlying social and psychological factors in decision-making are of central concern. At first, simplistic notions about what constituted "rational" behavior dominated the field, leading to models that, while appealing, did not reflect the actual behavior of most decision-makers. These early theories dealt with what were believed to be the two major ingredients in decision-making: the **probabilities** of various events associated with a decision alternative, and the **values** associated with the occurrences of those events. It was found that real decision-makers often do not, as theory predicted they should, combine these two ingredients so that their decision is made on the basis of maximum expected value across all alternatives.

Substitution of **subjective probabilities** for actual probabilities and **utilities** for objectively determined values resulted in more realistic theories but shifted the emphasis from the mathematical to the social sciences. At present, the major concern in the study of human decision processes is how to determine subjective probabilities and utilities rather than how to manipulate them.

The time-delay (recency) effect and biases related to perception and cognitive processes illustrate some shortcomings of contemporary decision theory. They point out a possible synthesis of behavioral theories of learning on the one hand and decision theory on the other. Most early theories of decision-making disregarded certain important psychological and social dimensions of human behavior that play a crucial function in the decision-making process—for example, persons' tendency to "discount" the future when choosing alternative courses of action. Behavioral-learning theories, for their part, typically fail to take account of the planning and goal-seeking behavior of humans engaged in such tasks as information processing and problem solving.

Thus, a theoretical approach to decision-making that uses behavioral science knowledge as well as the theoretical power of formal mathematical models might well increase the feasibility of affecting

persons' decision-making processes. Certainly, taking account of certain human "limitations" that make people less than ideal decision-makers may make it possible to formulate decision-making aids that would improve their ability to make good decisions, or assist them in avoiding some of their poorer decisions. Also, many individuals solve problems by ignoring utilities, ignoring probabilities, or following internalized scripts (in effect ignoring both utilities and probabilities). That these persons use defective decision-making models must be considered when developing countermeasures to unsafe driving behavior.

With respect to risk perception, the literature on human behavior identifies several factors relevant to highway safety. For example, in perceiving probability or risk, people tend to:

- make insufficient use of available information,
- be influenced by preexisting attitudes or beliefs,
- have selective distortions of memory when evaluating their own performance,
- be influenced by others in a group, and
- have difficulty in understanding concepts of randomness and probability.

All of these factors represent points at which society might intervene to improve driver decision-making. When these difficulties exist, drivers suffer from a perception gap between perceived risk and actual risk. Efforts to narrow the gap would clearly be enhanced by taking cognizance of what already is known in the field of decision theory and the behavioral sciences. Further reduction of the perception gap will become possible when contributions of mathematical modelers and statisticians are combined with those of behavioral scientists to form an integrated theory of human decision-making processes.

CHAPTER THREE
SOCIAL CONTROL

The purpose of this study is to identify human-oriented countermeasures by which the incidence of conscious UDAs and the consequent crash risk can be reduced. Because all UDAs are the product of some human behavior, and because behavior can be shaped or changed, it is important that the means by which individual behavior is developed, changed, and maintained be examined. In addition, the decision-making literature pointed out that many human decisions are influenced strongly by the values, attitudes, and beliefs that an individual holds. People's values, attitudes, and beliefs are also determined by the social-control forces surrounding them.

The materials contained in this section are presented to acquaint the reader with the basic concepts of social control that relate to driver behavior. Not all of the concepts presented here are equally applicable to the development of risk management strategies and countermeasures; for example, it would be more difficult to deal with driver behaviors stemming from early childhood experiences than those that are learned through association with other drivers. Nonetheless, it is important to learn in a general sense what means of intervention are suggested by the social-science literature and how intervention might operate.

LEVELS OF SOCIAL CONTROL

The term "social control" includes a variety of control forces that are exerted on the individual by those around him or her. These forces differ widely with respect to the control agent, the content of the control, and the way in which control is exerted. One way of classifying control forces is by the **level of control.** Social behavior theorists discuss social control on three principal levels: the **primary, secondary,** and **tertiary** levels. Their main distinguishing characteristic is the person or persons

who are the agents of control.

Two other terms are important to a basic understanding of social control: **socialization** and **internalization. Socialization** is the process by which a person's behavior is brought into conformity with the values of the culture to which (s)he belongs. One such value of interest to this discussion is the avoidance of conduct that poses an unreasonable risk of harm to others. Socialization focuses upon "the whole process by which an individual develops through transaction with other people, his specific patterns of socially relevant behavior and experience" (Zigler and Child 1969). The social-control techniques discussed here are regarded as the most important factors in the socialization process.

Internalization is a critical concept in the area of social control. It refers to the process of transferring social control from an external agent (such as a police officer) to the internal control mechanisms of the individual. Research in the area of crime and traffic has indicated that lack of internalization reduces behavioral compliance with the law. Research by Joscelyn, Bryan, and Goldenbaum (1971) as well as Brackett and Edwards (1977) suggests that for some drivers, lack of internalized control results in noncompliance with the posted speed limit. These investigators note that only when a control symbol (i.e., a police officer) is present will those drivers comply. Once the external symbol is removed, drivers may resume their violation of the speed limit in the absence of internal controls. Internalization, therefore, is a desired outcome of the social-control techniques discussed here, because through internalization, the incidence of risky behaviors can be reduced without complete reliance on external controls.

The social control that can produce socialization and internalization has been divided in the sociological literature into three distinct levels. Each level contains its own identifiable agent of control, a specific set of behaviors to be controlled, and a particular process by which the control mechanisms operate. Each is discussed in sequence.

Primary Level

The primary level of social control develops at the individual level and occurs primarily during the socialization experiences of early childhood. This is the level at which basic notions of proper and improper behavior are learned. The child's compliance with the primary socialization process is induced by a system of rewards and punishments that are administered by the child's immediate environment (primarily parents or their surrogates). The behavior of the child determines whether rewards or punishments are forthcoming. The terms "reward" and "punishment" are used in the psychological literature while the corresponding terms "positive" and "negative" **sanctions** are more commonly used by sociologists. Through reward and punishment, therefore, the child learns to distinguish between proper and improper, and between socially acceptable and socially unacceptable behaviors.

In addition to learning socially proper behaviors at the primary level of socialization, a child learns to respond to authority. It is this function that allows for the continuing development of social prohibitions in the individual. By legitimizing authority, the early socialization experience sets up the conditions necessary for the internalization of prohibitions throughout life. The outcome of a successful socialization experience, from society's viewpoint, is the internalization of the proper and improper behaviors as well as the concept of the legitimacy of authority.

One point deserves mention here. The term "authority" could refer to any of a number of persons or institutions in society. Some of these persons or institutions, such as the leader of a delinquent gang, might not be the same ones that are recognized as legitimate by the rest of society. Therefore, the socialization process might not always follow the socially acceptable direction. Children could learn behaviors that are correct for their social position but improper for the larger society. Subcultures can and do generate sets of behaviors that are in direct conflict with the larger society: Miller (1958), for example, identified a number of attitudinal sets (e.g., "tough") among delinquent youths. Being socialized in a subculture where the outside (socially dominant) authority is not legitimized can lead to later rejections of the dominant authority

sources. These conflicts between subculture and dominant culture rules and norms may account for differences in behavior not only on moral issues but on issues of traffic law compliance and related behavior. Although the case of subcultures and delinquency is an extreme one, the fact remains that society is heterogeneous and that groups within society differ in their definitions of proscribed behaviors.

Secondary Level

The secondary level of social control occurs within an individual's social environment. This environment consists of school and play groups for the child and work and recreational groups for the adult. These groups are informal, and are selected by the individual. An individual's selection of groups, however, is not independent of his or her prior socialization experience. It can be inferred that those with strong internalized controls will select other high-control groups and vice versa. In either case, secondary control is produced by interaction with other people within a social group.

To maintain predictable behavior in its members, the group uses a system of rewards and punishments. Rewards (positive sanctions) include acceptance, survival, friendship, employment, and emotional support; punishments (negative sanctions) include ostracism, hatred, and emotional withdrawal.

It is not clear to what extent secondary control forces affect an individual's driving behavior. Although it is conceivable that some persons will habitually associate with antisocial drivers (for example, a group of youths who regularly hold drag races on public highways), it cannot be said with assurance that incompetent drivers, or highway risk-takers in general, will gravitate to poor driving groups.

Tertiary Level

The tertiary level of control is external to the individual and to the individual's social groups; it is the control exerted by the socially powerful. This control is implemented through a larger social or political organization. For example, to deter crime, society has created a criminal

justice system that acts through the police, courts, and corrections authorities, and is supported, for example, by driver-licensing authorities, mental hospitals, and public health departments. The traffic law system, a subsystem of the criminal justice system, is society's formal mechanism for dealing with drivers who take socially unacceptable risks (Joscelyn and Jones 1972), and is perhaps the best known tertiary control mechanism for reducing the traffic crash risk.

In all cases, the agents of the tertiary level are formal organizations commissioned through legitimate channels of government and designated to control behavior. Their control takes two forms: **direct control** and **symbolic control**, which are known as **special deterrence** and **general deterrence**, respectively. (These are discussed in more detail later in this chapter.) Social control agents on the tertiary level--as in the primary and secondary levels--maintain proper behaviors through the administration of positive sanctions (rewards) and negative sanctions (punishments).

PSYCHOLOGICAL THEORIES OF SOCIAL CONTROL

Because risk management in effect means the management of individual and group behavior, it is essential that it rest on identified formal theories and principles. Two major disciplines that concern themselves with human behavior, **psychology** and **sociology**, have developed relevant theories and principles.

Psychology is, in its simplest terms, the scientific study of behavior, the focus of which is the individual. Sociology is also the study of behavior, but with reference to the groups to which the individual belongs. This section presents two general areas of psychological theory that are relevant to driver behavior: **learning principles** and **developmental principles.** Sociological theories are discussed in the next section.

Learning Theories

Learning principles are concerned with the role that experience plays in the modification of any behavior, including driving behavior. It is

postulated that three basic learning processes underlie socialization: **classical conditioning, operant conditioning,** and **observational learning.** Each approach has implications for bringing about change in driving behaviors.

Classical Conditioning. Classical conditioning is particularly useful for exploring and explaining the acquisition of emotional responses in humans. John Watson (Watson and Raynor 1920) was one of the first to demonstrate these implications. He directed an experiment conditioning a fear response in a child. The child, who was eleven months old, was not afraid of a white rabbit but did cry at the sound of a loud noise. Watson systematically presented the child with a white rabbit (known as a **conditioned stimulus**), then made a loud noise (known as a **unconditioned stimulus**). After several pairings of the rabbit and noise, the child cried when he saw the rabbit even when the noise was not presented. The child's crying is known as a **conditioned response.** Later, the child's response **generalized** to furry things. Interestingly, when a conditioned stimulus (in this case, the rabbit) was repeatedly presented **without** being followed by the unconditioned stimulus (in this case, the noise), its power to bring about a conditioned response gradually diminished and eventually disappeared (extinction). Researchers have, since Watson's time, classically conditioned a wide range of behaviors in people of all ages.

Applying classical conditioning principles to bring about emotional responses to unsafe driving acts is relatively straightforward. For example, a televised picture of an unsafe driving act (such as speeding) could be quickly followed by one of a gory, bloody crash scene. Repeated pairings and viewings by the audience should lead to their acquiring the emotional response to speeding alone and their subsequent avoidance of that behavior. According to classical conditioning principles, however, pairing of speeding and the crash scene would have to be repeated periodically to prevent extinction of the conditioned emotional response to speeding. It should be noted, however, that such conditioning of emotional responses is more relevant to the young than to an adult

population.

Operant Conditioning. The second learning process is operant conditioning. It differs from classical conditioning in that the individual actively participates in this learning process rather than remaining passive as is the case in classical conditioning. The outcome is therefore contingent upon the person's behavior. Accordingly, operant conditioning draws heavily upon the mechanisms of **reward** and **punishment.** Within this learning process, reward is termed **positive reinforcement;** it refers to the presentation of a pleasant stimulus (a reward) after a particular response or behavior has occurred. Awarding motorists a reimbursement check at the end of a "good driving" year is an example of positive reinforcement; as an additional incentive, this reward could be increased for each subsequent year of good driving. The goal of the positive reinforcement mechanism is to increase a particular behavior--in this case, good driving. Punishment is termed an **aversive stimulus** that is presented following a particular behavior. The goal of punishment is the reduction of a certain response. For example, when a motorist receives a citation (the aversive stimulus) for exceeding the speed limit (the behavior), punishment should lead to an eventual decrease in speeding.

In addition to the reinforcement mechanisms of reward and punishment, two mechanisms used by agents of social control are **negative reinforcement** and **omission training.** Negative reinforcement refers to the **removal** of an **aversive** stimulus after a particular response. Its aim is similar to that of positive reinforcement—to increase desired behavior. The buzzing in an automobile as a reminder to fasten the seat belt is an example of negative reinforcement. The behavioral goal of the buzzing sound is to increase seat belt use. To terminate the buzzing sound (remove the aversive stimulus), the motorist must buckle the seat belt (the desired response).

Omission training, like punishment, has the reduction of a particular behavior as its goal. It refers to the **removal** of a **positive** stimulus after a certain response. The removal of driving privileges (the positive stimulus) after committing a hazardous driving act (the behavior)

illustrates omission training.

Like classically conditioned behavior, operantly conditioned behavior can be extinguished by withdrawing reinforcers. How readily extinction takes place depends upon the conditions and schedules of reinforcement under which the particular behavior was learned. To use a traffic example: Drivers in Group A are stopped by a police officer each time they commit a UDA (a continuous reinforcement schedule). Drivers in Group B are stopped, on the average, once for every five UDAs (a partial reinforcement schedule). Operant learning theory predicts that when the enforcement symbol (here, the police officer) is withdrawn or absent, drivers in Group A will resume their unsafe driving habits sooner than will the drivers in Group B. Under continuous reinforcement schedules, every desired response is reinforced; thus, behaviors learned under these schedules are extinguished fairly rapidly. Under partial reinforcement schedules, however, responses are reinforced only occasionally; thus, these behaviors are more resistant to extinction than behaviors that have been continuously reinforced.

One final issue regarding the operant learning concerns the effectiveness of punishment. There has been debate over the usefulness of punishment as a socializing tool. Investigations of its effectiveness in inhibiting socially unacceptable behavior indicate ambiguous results at best. This is also true in the area of driving behavior. Research suggests that the manner in which punishment is administered influences its effectiveness in inhibiting unacceptable behavior. These aspects are discussed in more detail later in this chapter.

Modeling. The third learning process is that of observational learning or **modeling.** Basically, modeling refers to the learning of a behavior by observing other persons. Designing and developing countermeasures based upon the observational learning approach is fairly straightforward: Appropriate models are chosen and their safe driving behaviors made known to an audience, either through direct daily observation of others or vicariously through common media such as television, radio, newspapers, magazines, and motion pictures. Careful consideration must be given in

choosing driving models for a particular population or audience. Research indicates that the characteristics of a model can influence how much an observer imitates the model's behavior: High-status models are more likely to elicit imitation than are low-status models; same-sex models are more apt to be imitated by the observer than are different-sex models. Thus, in an activity- or athletic-minded community, a sports celebrity could be used as a model of safe driving actions; a highly regarded representative of the truckers could be used as a model for the truck-driving community. By observing such models, individuals can learn safe driving behaviors that they can reproduce later.

It is apparent that the focus of the learning theorist's approach to driving behavior is to understand observed responses in the presence of certain stimuli. To change a particular driving behavior, stimulus conditions must be manipulated.

Developmental Theories

A second psychological approach to the study of the socialization of socially acceptable behaviors emphasizes developmental stages of growth. Developmental concepts of growth and maturation in cognition provide an alternative approach to using reward and punishment or sanctions in the design and development of UDA countermeasures. Developmental theories stress the stable and predictable changes in human development that influence an individual's receptivity to socialization pressures; they focus upon interaction of maturation and experiences. The developmental framework that is probably most useful to the highway practioner is that of Piaget (1956).

Piaget's formulations of cognitive development, when applied to the area of traffic safety, suggest countermeasures based upon drivers' experiences. In Piaget's scheme, experience plays a key role in the socialization process. Socialization, in this framework, is a continuous adaptation to one's experiences and activities. Adapatation, however, is limited by the person's level of maturation. Piaget viewed maturation as a natural progression through qualitatively different stages of growth; therefore, the kind of learning that can occur at each level is

qualitatively different from the learning that was possible during the preceding stages. When individuals mature to a new level, they reach a more sophisticated level of conceptualization and perceive the world from a qualitatively different framework. Thus, in Piaget's framework, a constant exchange occurs between individuals' levels of maturation and their environmental experiences.

Piaget maintained that moral development proceeds through three stages: (1) **objective morality**, or blind obedience, in which moral concepts are based upon what is permitted or forbidden; (2) **interpretation-of-the-rules**, in which the person shifts from moral realism to moral relativism, distinguishes between the spirit and the letter of the law, and makes subjective moral judgments that lead to more consistent adherence to the rules in practice; and (3) **interpretation-of-the-act**, in which the person develops a sense of ethical and moral responsibility. Experience is an important factor in the development of the second stage, while the ability to reason is an important component to the third stage.

The application of Piaget's notions to driver behavior lead to countermeasures based on driver experience. Beginning drivers have little highway experience; their driving decisions are likely to be based on rules and laws. For these drivers, explaining the merits of traffic regulations is unlikely to have much meaning in the absence of experience. With increasing experience, however, a driver is better able to interpret and understand traffic regulations and can relate explanations of those rules to personal situations. That being the case, a driver education program could proceed in several phases and not end when a driver's license is obtained. The first phase should focus on teaching driving regulations and facts. A second training phase could occur after an individual has been driving for some specified length of time and has developed personal driving experience. This latter phase could then focus more effectively on explanations of traffic regulations and facts; in so doing, this instruction would be setting up the conditions under which a person can interpret traffic rules, thereby leading to a more consistent adherence to them.

SOCIOLOGICAL THEORIES OF SOCIAL CONTROL

Sociology attempts to explain behavior in terms of the groups to which an individual belongs. Because society is heterogeneous, individuals belong to a wide variety of groups. For that reason, no single sociological strategy could possibly affect the behavior of all drivers.

The areas of sociological theory that are most relevant to driver behavior are those that relate to crime. Although committing a UDA is not the same as committing a crime, there are enough similarities (both are hazardous to other members of society and both are formally prohibited and dealt with by society) that criminological theories have some application.

Within the area of criminology, theorists have devised explanations of why individuals commit crimes, and more importantly, how to control that behavior. Two theoretical trends in the sociology of crime are especially important to driving behavior: the **interactionist** school and the **control** school. These are discussed in order.

Interactionist Theory

The interactionists (e.g., Sutherland and Cressey 1974) maintain that all behavior, criminal and noncriminal, is learned by association with others in intimate groups that share attitudes and beliefs favorable to a behavior. These interactions, therefore, occur primarily at the secondary level of social control. The interactionists suggest that the attitudes and beliefs held by the social environment condition individuals' behavior; that is, if one associates with delinquents, then the probability of becoming a delinquent is increased. Jensen (1972), Voss (1964), and Kobrin (1951) have documented this hypothesis in their studies of delinquency.

Interactionist theory has already been adapted to explain such behaviors as white-collar crime and police occupational behavior. The theory identifies causal factors of behavior, including: learning about a behavior through communication with others in intimate personal groups; learning the particular techniques of committing a behavior; learning the attitudes, motives, drives, and rationalizations supporting a behavior;

learning attitudes and behaviors on a priority basis according to varying scales of duration, frequency, and intensity of exposure; and learning behaviors by associating with groups supporting the behaviors.

Applying this theory to traffic behavior does require a change in content from crime to traffic violations. The translation can be arranged in the following manner. A person learns improper driving behavior through association with such intimate personal groups as a peer group. If this group supports traffic-violating behavior, then the person will learn the techniques of violation, and, more importantly, the attitudes, drives, motives, and rationalization that support this violating behavior. Finally, the incidence of the improper traffic behavior is based on the duration, frequency, and intensity of the association with the group supporting some violation of traffic rules.

However, as in the case of secondary group influences, it cannot be said with certainty that all the groups to which a risk-taker or an incompetent driver belongs will consist of similar drivers. Driving behavior normally will not have the same prominence in a person's life as more serious crime or delinquency.

Control Theory

A second sociological theory of behavior, Hirschi's control theory, has been adapted by Minor (1977) to describe traffic behavior. Hirschi's theory (1969) maintains that a person's behavior is controlled by bonds to conventional society. Specific elements of these bonds are: an objective attachment to conventional others; a rational commitment to conformity; a time-consuming involvement in conventional activities; and belief in the personal legitimacy of the law. Minor's adaptation changed Hirschi's original model by replacing time-consuming involvement with fear.

The control model allows the relative effect of each factor on improper driving behavior to be ascertained. Fear, for example, was found to have such a small effect on traffic behavior that Minor suggested it be eliminated from the model; in contrast, belief in the legitimacy of the law was found to have a relatively large effect on this behavior. Attachment was also found to affect compliance in traffic

behavior.

This model suggests interesting policy implications. If fear of apprehension plays a small role in controlling improper behavior, while a belief in the legitimacy of the law plays a substantial one, countermeasures should be directed toward increasing the individual's belief in the law rather than towards increasing fear of apprehension or fear of traffic crashes. Note that controls may differ, depending on the driving behavior in question. The driver who stops for a red light at a deserted intersection at midnight is more likely prompted by respect for the law than a truck driver who drives at reduced speed on heavily traveled expressways for fear of getting a ticket.

LEGAL THEORIES OF SOCIAL CONTROL

As pointed out earlier, this study considered a wide range of risk-management strategies to reduce the incidence of UDAs. The possible areas of countermeasure activity include—but go well beyond--the formal systems and strategies used by society to deal with risky drivers.

This section discusses one particular mechanism of social control: the formal actions of the Criminal Justice System and the Traffic Law System to reduce the incidence of behavior that is formally prohibited. The actions of these formal systems are considered in the larger context of the social-control theories presented here.

The previous section discussed a number of psychological and sociological concepts regarding the processes of socialization and social control. It was noted that individuals' behaviors can be controlled by systems of rewards and punishments. These systems operate on a number of levels: primary, secondary, and tertiary. The threat of formal legal punishment, administered on the tertiary level, has been labeled **deterrence.**

The concept of deterrence refers to activities initiated by the government (an agent of tertiary level control) and directed at the reduction of improper activity by members of the society (Gibbs 1975). In the deterrence framework, individual behavior is hypothesized to stem from the risk they perceive of receiving negative sanctions for engaging

in prohibited behavior. Andenaes (1966) refined the concept of deterrence by noting that it is composed of two elements: the **actual effect** of sanction, and the **symbolic effect** of the threat of sanction.

The actual effect is called **special deterrence;** it refers to the effect of sanctioning specific individuals to deter them from engaging again in a particular behavior. Special deterrence is used by practitioners in the area of traffic behavior, such as when a driver's license is revoked for continued prohibited driving actions. In effect, the sanction deters the person from driving, from committing further UDAs, or both.

The symbolic threat of sanction is referred to as **general deterrence.** It operates by dissuading individuals--whether punished or not--from committing a violation in the first place. Both general and special deterrence operate on the same principle—that is, the threat of negative sanctioning. A number of researchers (Gibbs 1975; Andenaes 1974; Zimring and Hawkins 1973) have investigated how the threat of sanctioning affects improper behaviors. Their findings are of interest to this discussion.

General Deterrence: Theory

Synthesizing Gibbs (1975), Andenaes (1974), and Cooper (1973), general deterrence refers toactivities with symbolic overtones initiated on the tertiary level of control that are directed toward the elimination or curtailment of improper, criminal or unsafe actions by employing negative sanctions. The effectiveness of general deterrence is based on the power of the control symbol. This power consists of three subjective elements: certainty, swiftness, and severity. This symbol's power is, in turn, directly affected by the individual's **perception** of the certainty, swiftness, and severity of the symbol's power.

Implicit in the above definition of general deterrence are three assumptions. First, the definition assumes that the individual perceives that a control symbol and a threat of sanction exists. Second, it assumes that the individual is motivated by hedonistic drives that determine one's decisions to engage in improper behavior; according to this notion, the individual will engage in behavior that is the most rewarding and avoid behavior that is the most costly. This was discussed in the

decision-making materials in Chapter Two. Finally, the definition assumes that the control system has the capacity to discover and sanction improper behavior. The efficacy of general deterrence rests on the validity of these assumptions. For discussions of the validity of these assumptions, see, for example, Blumstein, Cohen, and Nagin (1980), and Wilson and McLaren (1972).

The sanction factor itself is composed of three elements: **certainty, swiftness,** and **severity.** These are defined as the objective components of the deterrence doctrine. They refer to the actual capacity of the control system to deliver sanctions as well as to the content of the sanction itself. In all cases, the law is treated as a given and there is no discussion of its origin or objective legitimacy. Instead, the objective components consider the impact of how the law is **administered.**

Certainty of eventual punishment is the first objective element to affect a sanction's deterrence potency. Police are aware of only 50% of the crimes committed and arrest individuals in only 16% of those known crimes (U.S. President's Commission on the Causes and Prevention of Violence 1966). This is partially because of the limited number of police. The national average is 2.5 police officers per 1,000 population (U.S. Departments of Commerce and Justice 1979). We estimated in the final report of the police enforcement project that there are only about 100,000 full-time-equivalent police officers performing all 4 of the functions of police traffic services (Joscelyn and Jones 1980). We also estimated that at least 10 times as many officers would be needed to provide a reasonable threat of apprehension for a speeding violation. Sheehe (1963) estimated that one in every 7,600 motorists could, on the average, expect to be ticketed for a speeding violation on a certain Michigan highway. Joscelyn and Jones (1972) conducted an attitudinal survey and found that individuals believe that their chances of being caught for a traffic violation are small, although their perceptions are higher than is actually the case. In short, the actual chance of apprehension is slight, thus reducing the effect of the sanction on driving behavior.

Thus, the threat of the sanctioning first of all depends upon the **certainty** that a sanction will follow an improper behavior. In keeping

with current knowledge of human decision-making, the threat of sanctioning is diminished if an individual knows there is a low probability of a sanction following a behavior. In regard to traffic enforcement, an individual will speed if he or she wishes to reduce travel time and, at the same time, believes that receiving a ticket or having a crash is not likely.

The second objective element that influences the deterrent effect of a sanction, the **swiftness** of the sanctioning process, involves the time period between committing an offense and receiving a sanction. This point is supported by other research as noted earlier in this section: the greater the time lapse between the behavior and the sanction, the less effective the threat of that sanction will be. In short, the deterrent effect of a traffic sanction is reduced if the sanctions are not received until long after the offense has been committed. While traffic sanctions are usually processed more quickly than are other criminal violations, there is still a time delay between the traffic violation and the sanction. This delay (in accord with the learning principles discussed in a previous section of this chapter) is likely to reduce the deterrence capacity of a traffic sanction. These time delays are difficult to eliminate in the present system, for they stem from constitutional and statutory constraints on criminal-justice and traffic-law system activity, as well as a lack of police and judicial resources to process traffic cases more rapidly.

The final objective sanctioning element is sanction **severity.** In general, increasing severity tends to increase the deterrent effect of a sanction. However, because determination of sanction severity is a value-laden process, there is much disagreement as to its effect on the objective power of the sanctioning process. What is more, penalties for traffic violations are fixed by political bodies such as legislatures and are applied by judges; thus, public opinion regarding the severity of these offenses must be considered. Ross (1960) asserts that the driving public views most improper driving as a folk crime that has little public condemnation attached to it. Lacking the force of public condemnation, most sanctions for traffic violations carry negligible power. Their main power is found in the financial inconvenience they create (Joscelyn 1975).

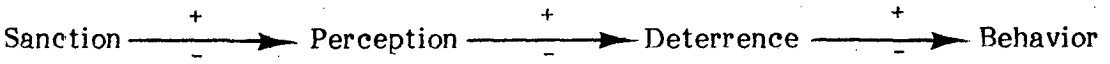
Much operant conditioning research supports the contention that with increasing sanction severity, the threat of the sanction (and subsequent deterrent effect) also increases. However, the results are not clearcut. Beccaria (1963) and Tittle and Rowe (1974) have noted a "U-shaped" relationship between severity of sanction and the incidence of the targeted behavior. When a sanction is not severe enough, it has no effect on an individual, and there is no threat. In other words, there appears to be a lower threshold limit. Likewise, there is a lessening of a deterrent effect at very high severity levels; Bankston and Cramer (1974) report that as severity increases, a "saturation point" is reached and the deterrent effect diminishes.

In summary, the power of the existing sanction elements to deter most traffic violations is low. First, the chances of punishment are reduced by limits on control agency resources. Second, the severity of the sanction is minor and no public condemnation or stigma follows conviction of most violations. Finally, the negative effects of sanctions are reduced by the amount of time by which the sanction follows the act. All in all, the objective power of the sanction is often minimal and is seen by the public more as an inconvenience than a serious threat (Joscelyn 1975).

Severity, swiftness, and certainty of sanctions interact to affect the **perception** of threat. For example, if both the severity and the swiftness of sanctions were very high, but certainty of detection were low, the overall threat would be minimal. In contrast, if certainty were high, but severity and swiftness were low, the overall threat nonetheless would be likely to deter the behavior of concern. In any event consideration must be given to each of the three elements and to their interactions.

One other point deserves mention. Since the focus of this report is on general risk-management strategies, emphasis is placed on general deterrence, which is one such strategy. Nevertheless, it should be noted that general and special deterrence cannot, in operational settings, be separated. Punishment of enough individuals must occur for any general-deterrent threat to be credible; conversely, any special-deterrence activity is likely to have at least some general deterrent effect.

The preceding definition of and assumptions about deterrence have been combined by Gibbs (1975) into a doctrine of general deterrence. Gibbs' doctrine states that the relationship between the sanction and the resulting behavior is mediated by two intervening factors: **individual perception** and the **deterrent effect** of the sanction. Pictorially, the doctrine can be described:



Perception of the certainty and severity of a sanction is the first intervening factor that, according to Gibbs, determines the effectiveness of sanctions on behavior. It can either enhance or minimize the power of a sanction: When drivers overestimate the power of control agencies to deliver sanctions, the deterrent effect increases; when they underestimate the power, the deterrent effect is reduced. Three elements are involved in this process of perception: the public perception of the legitimacy of the rule; the perception of the possibility of apprehension and sanctioning; and the value of the sanction to the individual. These elements make up the **subjective** power of the sanction (Erickson and Gibbs 1978; Gibbs 1975).

Public perception of the **legitimacy** of a rule, in part, determines individuals' compliance. The greater the public perception that a law is legitimate, the greater is their compliance with that law. Compliance with the 55 mph National Maximum Speed Limit (NMSL) is an appropriate example. The original purpose of the NMSL was to conserve fuel. Data show that compliance was greater in 1973-75, when drivers faced widespread fuel shortages, than in later years when fuel was generally available (Claybrook 1978).

Individual **perception of the probability of apprehension and sanctioning** is a second subjective element that affects the power of a sanction (Buikhuisen 1972). This perceptual element can be divided into two concerns. The first concern refers to simple awareness of the proscribed behavior on the part of the driver, that is, whether the driver was aware that a certain driving behavior violated the law. While drivers are generally aware of most traffic laws, there are some rules of the

road (such as basic speed laws requiring speeds to be appropriate for conditions, and rules concerning amber lights at intersections) that may produce confusion on the part of drivers. In other cases, drivers may not see or understand traffic signs. In addition, there are times when a driver inadvertently commits a driving act that he or she otherwise knows is wrong, for example, by following the pace set by other traffic exceeding the speed limit. The second concern relating to perceived probability of receiving a sanction involves drivers' perceptions of the probability of being apprehended should they consciously engage in illegal driving behavior. This determination is based on such factors as, the perceived probability of a police officer being present; the perceived probability that any officers who are present will take enforcement action; and the perceived probability of being sanctioned by a traffic court (see, Bailey and Lott 1976). These estimations of apprehension and sanctioning are based on the driver's past experience, the actions of other drivers, the driver's desire to avoid a sanction, and the personal gains received by violating the traffic rule (such as speeding and saving time, or following too closely and relieving frustration).

The final element of the perception factor deals with the meaning or the **value a specific act has for a driver.** Determination of value involves the decision processes described in Chapter Two. In formal decision-theoretic models, the value of an act is assessed by calculating its net, that is, the net desirability of the consequences of the behavior. Using this calculus, if the net gain is positive, the individual will violate the law; on the other hand, if the net gain is negative (that is, a loss), the driver will avoid the act. For example, drivers will speed to reduce travel time (a gain) if they perceive their chances of being caught (a loss) as minimal. The value or meaning of the act, then, is the determination of the net gain based on the perceived rewards and punishments of the behavior. Note, however, that the value of committing a particular act is not the only factor that determines whether the driver will commit it. For example, a driver who is already law-abiding might avoid committing a UDA even after determining that the UDA would produce a net gain.

The second intervening factor in Gibbs' deterrence doctrine is the **deterrent effect** of the sanction. Deterrent effect is a combination of the objective elements of the sanction and their subjective perception by the individual. If a rule is considered legitimate, the rate of apprehension high, and the rewards for violation minimal, the effect will be great and the individual will be deterred. Other combinations of these elements could reduce the deterrent effect of the sanction and thereby increase the incidence of risky **behavior.**

Empirical Research on General Deterrence: Objective Measures

Gibbs' general deterrence doctrine contains four major components: the sanction itself; individual perception; deterrent effect; and resulting behavior. It is therefore important to consider both the objective power of the sanction and its subjective power to produce a deterrent effect. Deterrence theory has been tested experimentally, and these experiments have been reported in the empirical literature dealing with the influence of objective measures of sanctions and the influence of perceived power of sanctions on compliance behavior.

Nagin (1978), who thoroughly reviewed the general deterrence literature, asserts that deterrence is "inherently an aggregate phenomenon," that is, its effects are reflected in the behaviors of an entire population. Nagin goes on to note that all analyses therefore use aggregate data on crime-commission rates with various sanction measures. The effects of general deterrence can be tested by observing the relationships between crime rates and the certainty or severity of sanctions for that crime. Three sanction measures in particular have been studied in the area of general deterrence. These are: probability of apprehension; probability of imprisonment; and severity of punishment.

Probability of apprehension has been measured in operational terms in two ways. The first is by "clearance rates," that is, the proportion of reported crimes that are solved. The second operational definition of probability of apprehension is the ratio of arrests to reported offenses. **Probability of imprisonment** is measured by the ratio of prison commitments to reported crimes. **Severity of punishment** is defined as

the mean or median time served by those imprisoned. Findings in each of these areas are discussed in turn.

Investigators have generally reported inverse associations between crime rates and the probability of apprehension. Likewise, inverse relationships have generally been reported between several crime categories and the probability of imprisonment.

As Nagin notes, however, the relationship between crime rates and **severity** of punishment is somewhat equivocal. Negative associations have been reported for homicide rates and for each offense classification within the index (serious) crimes category in only four studies: Ehrlich (1973); Bean and Cushing (1971); Gray and Martin (1969); and Gibbs (1968). Several investigators have found a negative association between severity of punishment and homicide rate, but no relationship between sanction severity and the rest of the serious crimes (Antunes and Hunt [1973]; Logan [1972, 1971]; Chiricos and Waldo [1970]; and Little [1969]).

Other investigators (e.g., Forst [1976]; Avio and Clarke [1974]; Sjoquist [1973]; and Vandaele [1973]) reported no significant association between severity of punishment and several crime categories. Moreover, Avio and Clarke (1974) found a positive association with robbery and with theft for the severity of punishment measure.

Another measure of general deterrence is that of police expenditure per capita. As Nagin (1978) notes this measure reflects the intensity of police presence with greater police presence hypothesized to be a deterrent to criminal activity. Relatively few studies have been done in this area; moreover, the results of these studies are equivocal. McPheters and Stronge (1974) and Swimmer (1974) report a negative association with "crime" for police expenditures, while Greenwood and Wadycki (1973) report a positive association. In neither case are the crime categories defined or described.

Although studies that focused on objective measures of the sanctioning process have not been concerned with traffic or driving behaviors but with more serious criminal activities, the research suggests that increased **probabilities** of apprehension or punishment can effectively deter illegal behaviors. However, the relationship between **severity** of punishment and

crime rates is not as clearcut, and results are equivocal at best. Likewise, no clearcut relationship has yet emerged between intensity of police presence and rates of crime.

Empirical Research on General Deterrence: Subjective Measures

The empirical research cited above has been concerned with the so-called **objective measures** of general deterrence (i.e., probability of apprehension, probability of imprisonment, and severity of punishment). Another group of studies in this area of deterrence deal with individuals' **perceptions** of punishment and deterrence. As Bailey and Lott (1976) note: ". . . deterrence theory suggests that it is one's subjective perceptions of punishment that are important, not the objective probability of apprehension and the actual sanctions that result" (p. 99). Perception studies have focused upon two populations: individuals classified as criminal or delinquent; and individuals not classified that way. Gibbs (1975) summarizes the underlying deterrence theory arguments for studying the perceptions of these two groups:

> If individuals commit crimes because they have not been deterred and if individuals refrain from crimes because they have been deterred, then those who commit crimes tend to perceive punishment as less certain and/or less severe than do those who conform to laws. Another way to put the argument is that criminals tend to underestimate both the objective certainty of punishment and the magnitude (presumptive severity) of statutory penalties (e.g., length of imprisonment), while normals tend to overestimate both properties of punishment (p. 209).

Results of studies investigating the relationship between participation in criminal activities and perception of sanctions are far from consistent. Waldo and Chiricos (1972) studied the relationship between certain self-reported criminal activities and perceptions of both severity of punishment and likelihood of being caught; they found a significant inverse association with the perceived **likelihood** of punishment for participation in both marijuana use and petty theft. However, the correlations between these two activities and the perceived **severity** of punishment were small.

Bailey and Lott (1976) also obtained measures of perceived probability

of apprehension and the severity of sanctions for a number of criminal behaviors. In addition, they obtained data on self-reported illegal activity. Their results indicated that each behavior was generally unrelated to either perception of apprehension or perception of sanction severity. Claster (cited in Bailey and Lott 1976) obtained similar results, finding no difference between delinquents and nondelinquents in their perceptions of the risk of arrest and conviction. Gibbs (1975) concludes that "contrasts between the two populations are not appreciable, and there is no convincing evidence that criminals or delinquents underestimate the objective certainty of punishment" (p. 209).

These above perception studies, however, are subject to basic methodological flaws. First, as Gibbs (1975) points out, in most studies, individuals identified as criminal or delinquent had been apprehended and convicted at the time of the study; it is possible that their perceptions were altered by the actual experience of punishment and thus did not reflect their perceptions prior to committing the crime. A better strategy would have been to assess the association between perceptions and the **subsequent** criminal or deliquent acts of the individuals within a given population. A second problem in this area of research is the exclusion of extralegal (e.g., socioeconomic, demographic, and regional) variables from data analyses. This holds true for both objective and perceptual measures of deterrence studies. Both Gibbs (1975) and Nagin (1978) note the important role that such factors play in generating or inhibiting crime.

One more issue warrants attention in the study of the effects of general deterrence (actual or perceived) upon crime rates or criminal activity: the nature of the offense or activity being investigated. Most studies focus on the "serious" crimes: Studies of traffic offenses are few, despite the fact that violations of traffic laws are the most common form of law violations in the United States (Ross 1960). However, Gibbs' survey of traffic studies (1975) indicates that the findings of existing traffic studies do tend to support the deterrence doctrine. Moreover, some kinds of traffic offenses are much more deterrable than others; specifically, parking violations were found more deterrable than moving

violations. Nonetheless, Gibbs criticizes the traffic studies in this area:

> . . . the defect of traffic studies is that they are often little more than casual observations about change in the number of **officially** reported traffic violations after a change in prescribed punishment or enforcement procedures (usually the latter). Even if such observations can be taken as studies, they are not fully reported, and they are rarely published in professional journals, which would ensure scrutiny by a critical and informed audience. (p. 210)

In sum, the empirical studies have yielded conflicting results regarding the effect of perceived probability and severity of punishment on subsequent behavior. Certain methodological flaws possibly contribute to the discrepancy in results; in addition, deterrence studies dealing with crime might not be fully applicable to traffic offenses.

SUMMARY

The design and development of adequate countermeasures to unsafe driving acts requires an understanding of how socially acceptable behavior can be effectively developed, altered, and maintained. This is the process of social control. In this chapter the fundamental principles of social control were described. Major theories and issues were identified and related to driver behavior; examples of how these principles have been applied in highway safety were noted where appropriate.

The literature reviewed was drawn primarily from the disciplines of psychology and sociology. As such, it included materials dealing with behavior on both the individual and the social level.

Three levels of social control have been identified and labeled by theorists: primary (family); secondary (voluntarily chosen groups); and tertiary (formal mechanisms established by society).

Two major psychological approaches relevant to the social control process for drivers were discussed: learning principles and developmental principles. The former emphasize manipulating certain environmental or social conditions to change a particular driving behavior. The procedure or strategy used to effect a behavior change depends upon the specific learning paradigm used. The developmental approach to social control

stresses an individual's adaptation to experience and suggests educational strategies that take account of driver experience.

Sociological approaches include altering informal group and societal attitudes and values toward driving and beliefs regarding legitimacy of authority. Two theories of group influence on behavior were discussed: the interactionist theory and control theory. The former theory states that behavior is learned by associating with groups whose attitudes favor certain behaviors, while the latter theory states that behavior is determined by an individual's bonds to conventional society.

Deterrence refers to activities initiated by the government (an agent of the tertiary social control level) and directed toward the curtailment of certain activities by the members of its society. Deterrence can dissuade individuals from committing a violation in the first place (general deterrence) or from committing further offenses (special deterrence). Because general deterrence is more pertinent to general risk-management strategies, it was the primary focus of this section.

Both the objective and subjective components of the sanctioning process were discussed in relation to their deterrent effect on behavior. Empirical research indicates that increased certainty of apprehension or sanctioning can increase the deterrent effect on certain illegal activities. Studies of the relationship among severity of punishment, intensity of police presence, and individuals' perceptions of the sanctioning process have yielded conflicting results; no clearcut relationship has emerged to date. Among the possible factors playing a role in these discrepant findings are: the study of the perceptions of persons already identified as criminal; the exclusion of extralegal variables from data analyses, and the nature of the offense being investigated.

CHAPTER FOUR
CONCLUSIONS AND IMPLICATIONS

The literature on decision-making and social control reveals several key principles that can be useful in designing human-oriented countermeasures for reducing the incidence of unsafe driving actions that are conscious and intentional. These principles and their implications for this project are discussed in this section.

SUMMARY OF RELEVANT PRINCIPLES

Some--but not all--UDAs are the result of driver decision-making that involves (a) consciously weighing the "pluses" and "minuses" or the outcomes of certain courses of action; and (b) choosing the course of action that is likely to produce the largest net plus (or the smallest net minus). Other UDAs result from "decision-making" that is rationally defective in that it ignores the probabilities, the values, or the outcomes that would result from a particular course of action. Still other UDAs occur in the absence of a conscious decision: Some are the product of inadvertent or unconscious behavior (such as speeding because the driver follows other vehicles ahead that are also speeding); others result from following an internalized "script" (such as speeding because Burt Reynolds does so in the movies, without regard to whether the speeding "pays off" in time saving or whether it is unsafe).

Even when drivers choose UDA or non-UDA behavior using a conscious decision-making process, each driver is likely to set up the decision problem in a different way. Each individual will assign a different plus or minus value to each outcome, and each will assign different probabilitites to the various outcomes. This is so because each individual solves decision problems in the context of his or her own "world-model." World-models differ from driver to driver, and are based on such factors as one's preexisting attitutes and beliefs, the influences of others, the

way in which one perceives the various possible outcomes, the information available for decision-making, and the biasing or reinforcing effects of prior, similar experiences. In addition, human beings are not skilled in understanding or applying the concept of probability, especially, as in the case of traffic crashes, when the chances of having an accident on a particular trip are extremely small.

Two major approaches that can be used to change driver's decision-making processes with respect to committing a UDA have been identified. The first of these, called the "external incentives" approach, attempts to rearrange the inputs that a driver considers in making a decision, but leaves the world-model intact. The second approach attempts to change the driver's world-model itself by changing the attitudes and values that help make it up.

The literature indicates that social control is relevant to the UDA problem in two major respects. First, social control forces produce external incentives, especially the threat of punishment, that a decision-maker will take into account in weighing the pluses and the minuses of committing a UDA. Second, social control forces influence the values, attitudes, and beliefs that help make up drivers' world-models. Changes in world-models can result in changes in driving behavior.

Some psychological theories of behavior state that human behavior can be conditioned: External stimuli presented to a driver will cause that driver to perform one behavior over another. For example, a prohibited behavior can be eliminated or reduced by following it with an appropriate stimulus: administering punishment or removing a reward. One weakness of conditioned-behavior techniques is that some conditioning must occur on some regular basis to maintain the desired response, for example, the absence of bad driving behavior. Other psychological theories maintain that behavior changes also arise from within the individual as the individual matures by adapting to experiences, learning to interpret laws regulating behavior, and eventually acquiring a sense of responsibility that leads to law-abiding behavior.

One sociological theory, borrowed from studies of crime and delinquency, stresses that an individual learns correct and incorrect

behaviors through interactions with other group members. Through these peer groups one also develops attitudes toward those behaviors. Another theory, also taken from sociological studies of crime, states that a person is more likely to engage in correct behavior if (s)he has strong bonds to conventional society: One controlled by those bonds is more likely to obey the law out of a perception that the law is legitimate than out of a fear of being caught and punished for violating it.

Social control can be exerted at any of three levels; the agent of each level of control varies. The primary level of social control occurs primarily within the family and is exercised by parents or their equivalents. Secondary level control is exercised within the peer group. Tertiary level controls are exercised by formally established and socially powerful entities.

A special case of social control exercised at the tertiary level is legal deterrence. It is administered through the criminal-justice system and its subsystems (including the traffic-law system). Its goal is to reduce the incidence of prohibited behaviors by threatening law violators with punishment. Deterrence directed at the individual violator and intended to discourage that person from committing future violations is known as special deterrence. Deterrence directed at the entire population, whether violators or not, is called general deterrence. General deterrence is society's best known strategy for general risk management. It is related to special deterrence in that a certain amount of the latter is necessary to maintain a credible deterrent threat toward other would-be violators.

The power of a deterrent threat depends first of all on its objective aspects: What is the certainty that punishment will follow the commission of a violation? How swiftly will punishment follow its commission? How severe will that punishment be? In addition to these objective factors of certainty, swiftness, and severity of punishment, the power of a deterrent threat also is determined by how an individual perceives that threat. When a person perceives a high probability of being detected and punished for violating a law, considers the punishment especially unpleasant, or has a high regard for the legitimacy of that law, the deterrent effect is comparatively greater and is more likely to result

in socially acceptable behavior.

In its application to prohibited behavior, including traffic violations, general deterrence has several weaknesses. The criminal justice and the traffic law systems are not omnipotent and cannot possibly apprehend every violator. Not all traffic violators consciously weigh the advantages and disadvantages of violating the law. Some traffic laws are not widely respected as legitimate, and others are not well understood by or not even known to the driver. Nonetheless, it is clear that the threat of punishment does discourage individuals from violating the law. Unfortunately, we do not yet know how much of what threat is required for given groups of individuals under given conditions.

IMPLICATIONS FOR COUNTERMEASURES

The use of different kinds of decision-making structures by drivers implies that no single countermeasure approach can be used to promote compliant behavior among all drivers. People who follow scripts may need to be approached differently than the integrators and synthesizers. The former group will need credible models of behavior to follow, while the latter require plausible information about the possible outcomes of a decision to commit or to not commit a UDA.

Drivers also differ with respect to memory and perception. Their objectivity depends upon both prior information, as well as their physical and emotional state. Their "utility functions" differ widely: a driver who attaches the greatest importance to the use of a car for transportation would be expected to make a different assessment of the utilities associated with a given UDA in a given situation than would a driver who attaches the greatest importance to recreational use of a car.

Thus, countermeasures may be expected to be more effective when they are focused at specific target groups with specific decision problems. Such countermeasures should then be applied at times when the group is most susceptible to them.

The time dimension will be, in fact, an important consideration in countermeasure design. Research shows that the amount of learning produced by a response to a behavior is a decreasing function of the time

delay between the response and the behavior. Further, decision-makers tend to "discount" the future and place more emphasis on the immediate consequences of a decision. Such "recency" phenomena indicate that countermeasures should focus more on the immediate consequences of a UDA or non-UDA decision and that rewards and punishments should be applied as soon as possible after a target event.

Research into the decision-making processes of humans clearly shows that people are not good at assessing probabilities, particularly small probabilities, and that past events or experience affect the assessment of probabilities. This suggests that countermeasures aimed at influencing decision-making should focus on the possible consequences of a decision rather than the probabilities associated with those consequences. When probabilities are addressed, they should be related to the experiences of the target group.

Finally, both the "external incentives" appproach and the "attitude change" approach should be used in countermeasures aimed at influencing driver decisions about UDAs. An example of the former approach is providing information to a driver that driving 70 mph instead of 55 mph on a twenty-five-mile commuting trip to work saves less than six minutes of commuting time. The latter approach might portray speeding as foolish rather than "macho" behavior.

The literature on social control indicates that the learning theories of psychology have many applications to human-oriented countermeasures against UDAs. Optimal use of well-known techniques for conditioning behavior has seldom been attempted in highway safety. When such techniques have been demonstrated (Brackett and Edwards 1977) they have not been widely adopted. Other applications should be investigated.

Research has demonstrated that socialization can be achieved through one's association with others. Again, this familiar principle has not been widely applied in highway safety. Countermeasures should attempt to use the more informal influences of groups (i.e., the secondary level of social control) rather than relying completely on tertiary-level approaches such as are embodied in legal-system strategies.

Legal-system strategies rely on the principle of legal deterrence to

realize their effects. This requires the establishment of credible and legitimate deterrent threats. Such threats cannot be established merely by passing a law proscribing unsafe driving behavior. Legal-system countermeasures require a relatively high likelihood that a prohibited behavior will quickly be followed by a punishment perceived to be sufficiently severe (but not too severe) by a driver.

The difficulty of accomplishing all of this within the constraints imposed through existing modes of operation of the traffic law system is enormous. New modes of operation that are not limited by such constraints as direct contact of law violators by a police officer should be sought in future legal-system countermeasures against UDAs.

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