Developmental Review **20,** 206–226 (2000)
doi:10.1006/drev.1999.0498, available online at http://www.idealibrary.com on IDEAL®

Risk Evaluation, Driving, and Adolescents: A Typology

Niki Harré

University of Auckland, Auckland, New Zealand

High road injury rates among young people throughout the world have prompted considerable research on what features of adolescence may contribute to this major public health issue. Widely divergent explanations, such as ''risk-taking'' attitudes, problems with risk perception, and the need to fulfill key developmental tasks, have been explored, but have not been systematically integrated. In order to provide such an integration, a typology is presented that outlines five psychological ''risk states'' that may be experienced by adolescent drivers. Two of these are considered desirable from a traffic safety viewpoint: habitually cautious driving and active risk avoidance. The others are undesirable: reduced risk perception, acceptance of risk as a cost, and risk seeking. Research on the relationship of these states to age and gender is outlined. Possible traffic safety interventions and implications for further research are presented. © 2000 Academic Press

The road injury rates of adolescents are a major public health issue throughout the Western world. International evidence consistently suggests that adolescent drivers are injured more often than older drivers (Evans, 1991; Jung & Huguenin, 1992; Lourens, 1992). There is good reason to believe that this high injury rate may at least in part be due to the tendency of this age group to engage in unsafe driving behaviors. Numerous studies have suggested that adolescent drivers are more likely to engage in a variety of such behaviors including speeding (Jonah, 1986; Wasielewski, 1984), failing to wear a seat belt (Cooper, 1987; Jonah, 1986), close following of the vehicle in front (Evans & Wasielewski, 1983), and aggressive or reckless driving, including driving under the influence of alcohol (Harrington & McBride, 1970; Jonah, 1990).

The problem has traditionally been viewed as largely, although not exclusively, a male one. In most studies that have reported gender differences, it

Niki Harré is a lecturer in the Psychology Department at the University of Auckland. Her research interests include child and adolescent health and safety issues. She has a Ph.D. from the University of Auckland. The Accident Rehabilitation and Compensation Insurance Corporation of New Zealand, which funded this research, is gratefully acknowledged. Dr. Jeff Field and Dr. Barry Kirkwood are thanked for their advice and encouragement.

Address reprint requests to Niki Harré at the Department of Psychology, University of Auckland, Private Bag 92019, Auckland, New Zealand. Fax: (649) 3737450. E-mail: n.harre@auckland.ac.nz.

0273-2297/00 $35.00

has been found that young males have a greater tendency to engage in unsafe behaviors than young females (e.g., Elliot, 1987; Evans & Wasielewski, 1983; Forsyth, 1992; Harré, Field, & Kirkwood, 1996; Wasielewski, 1984). However, one recent study (Finken, Jacobs, & Languna, 1998) found no gender differences in the number of risky driving decisions that were made by young people aged 17–24 years. Another study of college-age adolescent females found evidence for a wide variety of risky behaviors among this group, including risky driving (Shapiro, Siegel, Scovill, & Hays, 1998). Some studies have also suggested that, at least in the area of drinking and driving, young women's rates are increasing at a more rapid pace than those of young men (Moore, 1994; Popkin, 1991).

The observed overrepresentation of adolescent drivers in unsafe driving practices suggests that their high crash rates are not just about their relative inexperience as drivers or possible exposure to particularly hazardous driving conditions (see Laberge-Nadeau, Maag, & Bourbeau, 1992, or White, 1988, for empirical investigations of these factors). Instead, it implies that there is something problematic about the judgments or decisions that they make when driving.

But do adolescents consciously choose risky behaviors, or do they fail to perceive the danger in what they do? If they understand the risks involved, are these taken on willingly (or even enthusiastically), or are they taken on reluctantly in order to fulfill some other goal? What particular age-related cognitions and social contexts may underlie their choices? These questions are not new and have led to a great deal of writing and research. Adolescence has been described as a life phase during which ''risk taking'' is an inevitable part (Hurrelmann, 1990; DiBlasio, 1986), and young men have been viewed as having a ''risk-taking propensity'' (Evans, 1991) that explains their tendency to be involved in dangerous driving practices. Young men, relative to older men, have also been found to underestimate the level of risk in certain driving situations (e.g., Bragg & Finn, 1982) and to fail to recogize the degree to which they personally may be at risk of a crash (e.g., Matthews & Moran, 1986). It is also clear that certain developmental tasks, such as identity formation (e.g., Papadakis & Moore, 1991), peer group integration (e.g., Arnett, 1992a; Jessor, 1987), and the desire to achieve adult status (e.g., Moffit, 1993), are crucial factors underlying many of the risky driving choices made by this age group.

To date, however, the strands of this literature have not been integrated. Part of the problem is undoubtedly a concentration on the concept of risk taking as central to understanding adolescent driving, with much confusion over whether this label refers only to the young person's behavior or whether it is also intended to describe their psychological state. While some have argued that their use of the term ''risk taking'' simply describes measurable behavior that increases the chance of a crash (e.g., Cvetkovich & Earle, 1988; Jonah, 1986), others have suggested that risk taking inherently implies a

conscious knowledge of the risks involved (Irwin & Millstein, 1992; Wagenaar, 1992; Yates, 1992). Taken one step further, risk taking has been defined as not just conscious, but also deliberate, in the sense that the young person is taking a risk for the sake or thrill of taking a risk (e.g., Thuen, Klepp, & Wold, 1992). Jessor (1992) has suggested that a thrill seeking inference is implicit in the use of risk taking and so therefore the term should be avoided.

Why this semantic confusion matters is that it has hindered discussion on how young drivers think and why they think the way they do. Considerable work has already been done on the background factors that predispose some adolescents to problematic behaviors, including risky driving (e.g., Arnett, 1992a; Jessor, 1987; Moffit, 1993; Papadakis & Moore, 1991; Swisher, 1988). Theories arising from this approach tend to group together problematic adolescent behaviors and thus do not draw attention to distinctions between behaviors and the different factors and psychological processes that underlie them. Jessor's (1987) theory of problem behavior as applied to risky driving is explicit in this goal, in proposing a problem behavior syndrome. While there is clearly much value in this approach, it does not provide a framework for understanding the different kinds of judgments made by adolescents in particular driving situations and the subjective processes that characterize each one. It is suggested that a detailed understanding of these judgments is essential for the planning of effective interventions.

THE PSYCHOLOGICAL "RISK STATES" OF ADOLESCENT DRIVERS

This paper puts forward five psychological states that describe the judgments of young drivers. The states vary according to the subjectively perceived level of crash-risk, the value the young person places on a sense of ''being at risk,'' and the desirability of the state from a traffic safety perspective. The psychological states can be seen on Fig. 1. Before looking at the characteristics of each state in some detail, it is important to discuss the key dimensions along which they vary. The first of these is objective crash-risk. Clearly objective crash-risk varies from moment to moment according to numerous conditions outside the driver's control. However, an experienced and cautious driver will generally be able to respond to these variations in such a way as to keep the risk low at all times (although there are exceptional circumstances under which this is not possible). Conversely, drivers may certainly increase their risk of a crash by making unsafe judgements. Risk homeostasis theory, which has been very prominent in the driving literature, argues that crash rates are entirely governed by people's target level of risk, thus supporting a model in which objective crash-risk is most usefully portrayed as a function of the choices made by the driver (Wilde, 1982, 1988; Wilde & Murdoch, 1982).

The second dimension involves perceived risk, that is, the level of crash-risk the driver considers there to be at any one time. This ranges from low

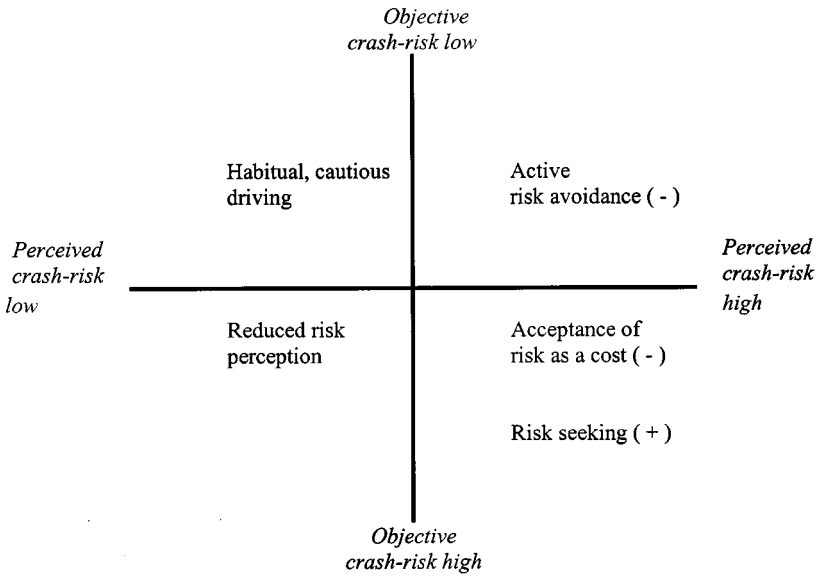

FIG. 1. The psychological ''risk states'' of adolescent drivers. *Key.* Subjective value of high perceived crash-risk: (−) negative; (+) positive.

perceived risk to high perceived risk. While drivers may often accurately assess the degree of danger involved in any particular scenario, it is also possible for a driver (and particularly an inexperienced driver) to consider there to be more, or less, danger than is actually the case. Finally, if the young driver feels at risk, then the subjective value given to the perceived risk is relevant. When the state suggests that a young driver enjoys the sensation of being in danger, this is indicated on the typology with a (+). When the state suggests that the young driver would rather avoid the sensation of being in danger if possible, this is indicated by a (−). This rating is not relevant for the two states in which the young driver does not perceive there to be high crash-risk.

The two states in the upper quadrants of the typology are considered relatively desirable from a traffic safety perspective. These are habitual, cautious driving and active risk avoidance. The three states in the lower quadrants of the typology reflect relatively high objective crash-risk and are thus undesirable from a traffic safety perspective. These are reduced risk perception, acceptance of risk as a cost, and risk seeking. While the states described here are all end points, they are clearly informed by background features as well as features in the immediate social context. Some of these background features may be common to the developmental phase of adolescence, while others may suggest personality characteristics and circumstances that affect some young people rather than others and thus reflect different develop-

mental pathways (see Magnusson, 1988). The focus of this paper is to draw attention to general features that are common to many in this age group and that predispose adolescents toward each of the risk states. The main purpose in highlighting these features, rather than individual differences, is that they are the most suitable targets for primary prevention strategies such as media campaigns, legislation, and school-based education that are aimed at the entire adolescent population. A systematic outline of individual differences in this age group that suggest secondary prevention strategies is beyond the scope of this paper.

THE RELATIVELY DESIRABLE STATES FROM A TRAFFIC SAFETY PERSPECTIVE

The relatively safe judgments made by adolescents have received little attention in the research literature, which has been intent on uncovering where it is that adolescent drivers go wrong. These are states in which the driver is motivated by what can be considered the primary goal of most everyday driving (and all traffic safety initiatives), getting to a destination safely.

Habitual, Cautious Driving

In this state, both perceived and actual risk are low. Most everyday driving I would suggest, and has been suggested by a zero risk model such as that put forward by Näätänen and Summala (1976), does not involve conscious awareness of potential crash-risk or a feeling of being near to danger. Very novice drivers may be exceptional in this regard, however, with risk tending to be highly salient in the early phase of learning to drive, as discussed below.

Active Risk Avoidance

This is the state in which young drivers feel at risk, but actively try to avoid danger. Research has suggested that the sensation of being at risk is inevitable when mastering the basic skills involved in driving (McDonald, 1985), and so it may be a relatively common state for new adolescent drivers.

THE RELATIVELY UNDESIRABLE STATES FROM A TRAFFIC SAFETY PERSPECTIVE

Reduced Risk Perception

When adolescent drivers have reduced risk perception, they underestimate the level of risk in a situation. The considerable empirical evidence that adolescent drivers may tend toward reduced risk perception can be divided into three categories. First, adolescents (or at least young men) appear to underestimate the risk in particular driving scenarios. Second, they appear to underestimate their chance of having a crash relative to their peers. Third, they may

be particularly vulnerable to situational variables that result in temporary reductions in their monitoring of crash danger.

Underestimation of the risk in particular driving scenarios. A number of studies have examined differences between younger and older drivers in how seriously they rate driving offenses (Brown & Copeman 1975) and how risky they consider various driving situations or behaviors to be (Bragg & Finn, 1982; Matthews & Moran, 1986; Tränkle, Gelau, & Metker, 1990). With an occasional exception, these studies have generally found younger drivers to perceive less risk in dangerous situations than older drivers.

It is of note that not all of these studies included women drivers (e.g., Bragg & Finn, 1982; Matthews & Moran, 1986). Those that did so did not find the same reduced risk perception in young women as in young men (Brown & Copeman, 1975; Tränkle, Gelau, & Metker, 1990). A relatively recent study by DeJoy (1992) found that young males considered risky behaviors less serious and less likely to result in an accident than did young females. Mundt, Ross, and Harrington (1992) also found male college students to judge the probability of an accident in various driving scenarios as lower than did female students.

Underestimation of personal crash-risk relative to peers. The existence of an optimism bias, in which subjects consider themselves safer or less likely to have an accident than average, has been found in all age groups of drivers (Forsyth, 1994; Guerin, 1994; Guppy, 1993). However, this bias appears to be particularly strong in young male drivers, who have consistently been found to perceive themselves as at less risk of having an accident than their peers of the same age and sex (Bragg & Finn, 1982; Finn & Bragg, 1986; Matthews & Moran, 1986). Due to a lack of studies that specifically compare women of different age groups on this dimension, it is difficult to know the extent to which this effect might be gender specific. However, one study of college students by DeJoy (1989) did not find any gender differences in a number of measures of personal optimism about avoiding crashes.

A notable feature of the studies on risk perception and young drivers is the *consistency* with which young (male) drivers have been found to have reduced perception of relative crash-risk in comparison to older drivers. While there is some empirical evidence for adolescents rating a variety of problematic behaviors as less harmful than ratings by their parents (Cohn, MacFarlane, Yanez, & Imai, 1995), two reviews have found mixed evidence of whether feelings of personal invulnerability are particularly concentrated in adolescence (Furby & Beyth-Marom, 1992; Quadrel, Fischhoff & Davis, 1993). Adolescents who achieve Piaget's stage of formal operations are likely to have reached this stage by 14 years (see Wagner, 1987), and there is little empirical evidence that this age group has poor decision making strategies relative to adults (e.g., Furby & Beyth-Marom, 1992). This suggests that potential differences in cognitive development are not the key,

although adolescents may consider different information and weigh consequences somewhat differently than adults (e.g., Igra & Irwin, 1996).

What this evidence suggests is that there may be something in the *social context* in which young people drive that leads to a particularly reduced realization of personal injury risk. One notable feature of this social context is the visibility of the driving behavior of their peers, a major reference group for adolescents (Arnett, 1992a; Jessor, 1992). Young people may not first decide they are safe, as suggested by Elkind's (1967) concept of egocentrism, (the idea that adolescents are embedded in their own point of view and so feel especially protected from harm), but instead first decide their peers are (more) unsafe.

There are a number of potential reasons why the poor habits of other drivers may be a large part of the thinking and reasoning of young drivers. First, adolescents as a group and particularly those adolescents who are themselves ''reckless'' drivers may be exposed to reasonably regular examples of dangerous driving in their peers. These examples are likely to be highly salient to the young person, as negative behavior tends to be more noticeable than positive behavior (Guerin, 1994). The actor-observer effect (Jones & Nisbett, 1972) suggests that people tend to attribute the behavior of others to internal, dispositional causes and the behavior of themselves to external, situational causes. A few highly salient examples of the dangerous driving of specific others would quickly lead to believing these others to be ''dangerous drivers.'' One's own dangerous driving, however, is ''understood'' as being contextual and the few examples of this are not sufficient to balance out the overall picture of everyday cautious driving. Ironically, whereas we might expect the most reckless adolescent drivers to compare themselves unfavorably with their peers it may be that their greater exposure to dangerous driving, as part of their social context, actually accentuates their own sense of personal safety.

A second reason may be that adolescents, unlike adults, are often passengers of peers. A passenger, who is not in control of driving decisions, may well feel more distress than the driver at decisions that are perceived to be risky. Research on general risk perception suggests that people are particularly fearful of potential dangers that they feel they cannot control (e.g., Slovic, 1994) and are less likely to have an optimism bias about such events (Weinstein, 1980). Driving research also indicates that perceived controllability is a key factor in rating crash probability as low (Matthews & Moran, 1986).

Third, young men are likely to be highly aware that as a group they are perceived as dangerous drivers. In New Zealand constant media campaigns portray this group as the drivers who speed, drink and drive and who crash. To the individual young man, this view would undoubtedly help to reinforce the image of the dangerous adolescent driver, who could only be worse than oneself.

Temporary reduction in risk monitoring. The studies discussed above have assumed that reduced risk perception acts as a distal factor in affecting adolescent judgement, that is, it exists and can be measured outside the context of particular driving situations. There are, however, situational variables that may also result in reduced risk monitoring. It is suggested that young people may be relatively easily distracted by factors such as passengers and loud music as well as being particularly susceptible to the influence of intense emotion and alcohol.

Distraction appeared to be a major factor in an analysis of 130 minor crashes involving Canadian teenagers carried out by Rothe (1987). One third of the young drivers reported that they were talking with passengers or listening to loud music just prior the crash. In an in-depth interview study of 56 young male British drivers, Rolls and Ingham (1991) also found numerous reports of situations where the young people claimed to be distracted by the presence of passengers or loud music.

The role of intense emotion in leading to risky driving in adolescents through reduced risk monitoring is difficult to ascertain. Rothe's (1987) study found situations likely to involve intense emotion to have preceded the crash in 25% of the cases. There have also been a number of studies that have suggested personality factors such as a high intensity of anger and aggression (Donovan, Umlaf, & Salzberg,1988; MacMillan, 1975), emotional instability and impulsiveness (Beamish & Malfetti,1962), and emotionally involved driving (Harrington, 1972) are more characteristic of drivers (both adolescent and adult) who have a history of crashes or violations than those who have not.

There is also some evidence that young (male) drivers may be more *prone* to driving when experiencing intense emotion than older drivers. One early American study by Schuman et al. (1967) of young men found that 40% of the 16–20 year olds surveyed had driven to ''blow off steam'' in the previous year, compared to 20% of 23–24 year olds. Jung and Huguenin (1992) found Swiss drivers under 24 years to report more driving to ''let off steam'' than drivers aged 30–34. Teenagers of both genders have also been found to consider the car a particularly suitable place in which to ''cool off after an argument'' (Farrow & Brissing, 1990).

The evidence cited so far suggests that drivers who experience intense emotions may have a relatively high crash rate and that adolescents may be more prone to some types of emotional driving than adults. What is unclear, however, is whether intense emotion is best viewed as a potential ''distraction'' that reduces risk monitoring or rather acts as an incentive to engage in active risk seeking, a rather different psychological state. In fact, it can probably operate in both ways. In one scenario, the young person may be so overwhelmed by an emotion such as anger that hazards are not noticed, and poor judgments are made. In the second scenario, the anger fuels a desire to *take* risks such as speeding, cutting corners, and so on. Alcohol is similar

in this regard. Whereas it can certainly disinhibit risk seeking, as will be discussed later, it can also act to reduce risk perception.

In discussing the possible function of alcohol in reducing risk monitoring in adolescent drivers, it is important to note that drivers under the age of 20 are probably not the worst offenders for drinking and driving (Cooper, 1987; Jonah, 1986; Schuman et al., 1967). However, it seems that whether teenagers in fact drink less frequently or drink smaller amounts than older drivers they are likely to be more adversely effected by alcohol than older drivers and crash at lower blood/alcohol levels (Carlson, 1972). There are several ways in which alcohol may function to reduce risk monitoring. As a sedative, it increases drowsiness (Bailey & Carpinter, 1991). It also may impair information acquisition (Johnston, 1982), which could be due to a reduction in the rate of peripheral detection (Rockwell, 1972). Alcohol reduces the ability to deal with two tasks at once (Brewer, 1980; Johnston, 1982). Its effects may therefore be particularly problematic when a young driver is trying to interact with passengers as well as perform driving tasks (Krüger, 1990).

Summary: the types of reduced risk perception. Three types of reduced risk perception have been discussed above. Two of these, underestimation of the risk in particular driving scenarios and underestimation of crash-risk relative to peers, act as background factors that may inform the judgments of young people, in particular young men. The third, a temporary state of reduced risk monitoring has been less explored in the literature. Nevertheless, it is worth further study to investigate whether young people more frequently drive under conditions that may reduce risk monitoring and whether their judgments are more affected by these conditions than those of adult drivers.

Intervention implications. The interventions that are suggested by each type of reduced risk perception are discussed in turn. First, young men's lack of recognition of the riskiness of some driving scenarios suggests that it may be useful to offer this group driver training directed at increasing their understanding about hazardous behaviors and conditions. Such training has been used with pilots, who have been successfully taught to analyze, and therefore avoid, the risks that may be involved in choosing particular courses of action under specific conditions (Bagheera-Buch, 1984; Jensen, 1982). However, mixed results for driver training in the past (e.g., Lund, Williams, & Zandor, 1986; Gregersen, 1994) make it difficult to assess the potential efficacy of this approach. There may also be a place for media campaigns that draw attention to the dangers in certain driving scenarios.

Second, if part of the reason that young men feel relatively invulnerable to crashes is because they are constantly confronted with the dangerous driving of their peers, it may not always be desirable for media campaigns and the like to draw further attention to the reckless driving habits of this group. Instead, it may be important for such campaigns to point out that most people, young men included, drive cautiously most of the time and to illustrate this with examples of safe driving. In other health contexts, it has been found

that high risk behaviors can be modified by describing the precautions that others take (Weinstein, 1984).

Third, if young people's driving is more affected by situational factors such as passengers, loud music, intense emotion, and alcohol, then attempts should be made to minimize young people's exposure to these features. In New Zealand, new drivers are not allowed to carry passengers for the first 9–18 months, when on a restricted license. All drivers under 20 years also have a blood alcohol limit of 30 mg of alcohol/100 ml of blood, which effectively means they cannot legally drink at all before driving. There is also a place for educating young people about the possible effects of distracting conditions, to encourage them to avoid these if possible.

Acceptance of Risk as a Cost

Adolescents may recognize that a dangerous driving behavior increases their risk of a crash, and judge this undesirable, but are prepared to accept this risk because they consider it necessary to achieve another aim. This attitude toward risk is consistent with several theories within the driving literature and more general decision making literature, which view behavioral decisions as resulting from a combination of perceived utility or value and perceived aversive consequences (see Adams-Guppy & Guppy, 1995). A finding among high school students in Indiana, that perceived value of an activity was more highly correlated with propensity to perform a behavior than perceived risk (Lehto, James, & Foley, 1994), may be explained by this psychological state: one in which risk considerations are outweighed by perceived benefits.

While all drivers balance the risk and utility of driving maneuvers, the scenarios that lead to increased risk being accepted as a cost are likely to differ between age groups. For example, young drivers have been found to take risks in order to avoid censure from adults, such as driving home after drinking to meet a curfew (e.g., Klepp & Perry, 1990; Vegaga & Klitzner, 1989). In Vegaga and Klitzner's study of 120 young drivers, females were particularly likely to report drinking and driving ''because they needed to get somewhere'' or because of unwanted peer pressure. Further examination of the scenarios faced by young drivers and how they apply in local contexts is warranted.

Risky driving may also serve developmental functions for adolescents, such as the need to achieve adult status (Moffit, 1993) and peer group integration (Jessor, 1987). When an adolescent *self-consciously* trades a sense of safety for these rewards, then this could be described as the acceptance of risk as a cost. One study by Rothe (1992) found Canadian young drivers were reluctant to admit their feelings of anxiety about driving in poor conditions to friends, for fear of ridicule.

Intervention implications. If adolescents are both aware that a driving behavior is risky and value the risk negatively, then alternative strategies that enable the risk to be avoided are likely to be welcomed. First, when risky

driving is undertaken in order to meet adult demands, then adult behavior may be an appropriate target for change. Solutions such as the contract initiated by Students Against Drunk Driving, in which parents agree to pick up the teenager or provide them with a taxi at any time of the day or night with no questions asked at the time, have been attempted (Blaylock, 1992). Cheap and convenient public transport is another potential solution.

There is also a place for social skills teaching in schools. For example, programs that use peer resistance skills have been found to be effective in school-based programs aimed at other health behaviors (Hansen, 1992; Flora & Thoresen, 1989).

Risk Seeking

The young risk seeker feels at risk and judges this to be desirable. The risk seeker is focused on making the most of the driving experience and so leaves little margin for error, with the challenge posed by the risk overwhelming the fear of the risk and the desire to be cautious. The aim of the risk seeker is to pass as close as possible without actually crashing, drive fast and still make it around the corner, or to cut across the railway crossing *just in time* to miss the train.

It may be that many drivers, across the age spectrum, enjoy some risk seeking. In a survey of French drivers, Barjonet (1988) found 30% of men and 23% of women considered risk a ''pleasure.'' It is likely that risk seeking is particularly prevalent in younger drivers, especially males. Jung and Huguenin (1992) found drivers under 24 years to report more driving to ''enjoy themselves and get the most out of the car'' than drivers aged 30–34 years. In a study of dangerous driving incidents reported by high school drivers, Farrow (1987) found 72% of the incidents involving male drivers to include ''reckless intent'' compared to only 28% of the female incidents.

Research on ''sensation seeking'' (Zuckerman, 1971, 1979) is also useful in this regard. The concept of ''sensation seeking'' as developed by Zuckerman involves four factors: thrill and adventure seeking, experience seeking, disinhibition, and boredom susceptibility. Studies have found correlations between scores on the sensation seeking scale and dangerous driving behavior (Arnett, 1990a, 1992; McMillen, Smith, & Wells-Parker, 1989; Yu & Williford, 1993). Males (Farrow & Brissing, 1990) and young people (Yu & Williford) have been found to score more highly on this scale. Young men have also been found to score more highly than other groups with regard to ''lethality,'' a related concept that includes an orientation toward danger and violence, bravery and adventure, and thrill seeking and fast driving (Thorson & Powell, 1987).

The finding that young people, and in particular young men, may tend toward sensation seeking is in keeping with other research in this area. Empirical evidence has suggested that high adolescent risk takers have better self-esteem and suffer less depression than low adolescent risk takers (Gon-

zalez et al, 1994), supporting the notion that some risk seeking is developmentally adaptive (Baumrind, 1987). The sensation of being at risk may particularly appeal to young *men*, due to physiological and hormonal characteristics (Arnett, 1992a). Trying out dangerous driving maneuvers may also aid this group in creating their gender identities (Papadakis & Moore, 1991), in a culture where seeking risks is part of the social construction of manliness (Hopkins & Emler, 1990).

The experience of voluntary ''risk taking'' (in adults) has been described in some detail by Lyng (1990) in relation to activities such as skydiving and rock climbing. It is worth briefly exploring here, as it draws attention to possible motivations that may underlie young men's risk seeking when driving. Lyng suggested that voluntary risk taking, which he called ''edgework,'' is a chance for participants to successfully meet a situation that uses all of their skills. While edgework activities involve a clear threat of death or injury, Lyng noted that ''participants often claim that only those 'who don't know what they are doing' are at risk'' (p. 857). This claim can be equated with a sense of personal invulnerability, similar perhaps to the optimism bias that young men appear to show in relation to driving. The result of a successful edgework experience is a heightened sense of self and feeling of omnipotence. Lyng suggested that edgework appeals to people who feel threatened by external social forces and who engage in voluntary risk taking as a way toward a sense of self-determination and authenticity.

There is some empirical evidence that risky driving may increase feelings of self-determination among some groups of drivers. Donovan, Umlauf, and Salzberg (1988) identified driving as a means of increasing personal efficacy, status, and power as one of the attitudes associated with increased driving risk in a sample of adult drivers. Perhaps more significantly for the purposes of this paper, another study found that adolescent males (significantly more than females) perceived the automobile as *making them more powerful* (Farrow & Brissing, 1990). If the numerous changes experienced by Western adolescents and their accompanying uncertainty (Petersen & Ebata, 1987) are put together with the high levels of confidence young men have in their driving skills (DeJoy, 1992; Stoddart, 1987), ''edgework'' on the road would seem almost inevitable among this group.

Both Jessor's (1987) problem behavior theory and Arnett's (1992b) notion of ''broad socialization'' also suggest that risk seeking on the road may be more likely when a young person's family and community do not provide strong controls, a common characteristic of Western adolescence (Arnett, 1992b).

While the nature of adolescence in Western society may provide a *background* for risk seeking behavior, it is also important to recognize that there will be *situations* in which risk seeking is more likely. The effect of intense emotion (discussed previously) and alcohol (Caces, Stinson, & Harford, 1991; Donovan et al., 1988; Jonah, 1986) in disinhibiting risky driving be-

havior is clearly significant. It is also possible that there may be peer group dynamics that encourage a mood of recklessness to descend. This is somewhat different from ''peer pressure'' as traditionally described (e.g., Havighurst, 1973), in which the adolescent is a unwilling victim, or the young Canadian drivers who were scared of their friends' ridicule if they admitted to feelings of anxiety about risky driving (Rothe, 1992). Instead, it is more like Arnett's (1992b) model that suggests adolescent friends may ''conspire to engage in [reckless] behavior together'' (p. 395).

Intervention implications. While there has been more relevant research on risk seeking than the other states discussed here, it is probably the most difficult state to shift. This is largely because it is propped up with an entire social system of norms and media images that equate fast driving and ''skillful'' maneuvers with masculinity, adulthood, and peer group approval. Dismantling these associations is a long and difficult process. One short-term solution may be to provide alternative venues for the display of driving skill. However, previous research that indicates professional race track drivers have higher on the road crash rates than average (Evans, 1991) suggests that it may not be possible to contain risk seeking in this way. There is also a place for continued legal sanctions against drinking and driving, as discussed previously.

Interactions between Psychological States

While the states outlined here are meant to be comprehensive, they are not necessarily mutually exclusive, in that more than one psychological state may be present in a single driving scenario. So, for example, a young man may pass recklessly both because it is enjoyable to feel close to danger *and* because he fails to fully realize the level of statistical risk involved.

Over time these states may also inform each other, so that time spent driving in one psychological state may gradually lead to increased time spent in another psychological state. For example, time spent in the state of active risk avoidance, which may be most commonly experienced by novice drivers who feel at risk almost all the time, may lead to the development of habitually cautious driving, in which the sensation of being at risk is no longer present.

Of more concern, however, the adolescent who often drives while accepting risk as a cost or who actively seeks risks on the road may start to experience reduced risk perception. The state of accepting risk as a cost may shift toward reduced risk perception through the mechanism of cognitive dissonance (Festinger, 1957). When accepting risk as a cost, individuals are likely to experience cognitive conflict between their desire to not perform the behavior because they consider it unsafe and their choice to perform it because of social pressures. In an attempt to reduce this dissonance, they may over time start to view the behavior as less dangerous. Risk seeking, on the other hand, may lead to reduced risk perception as the young person, increasingly aware of the benefits of the behavior (Lehto, James, & Foley,

1994; Smith & Rosenthal, 1995), ''rationalizes'' their reckless (risk seeking) choices (Gardner, 1993).

Whatever the initial motivation the young person has for risky driving, the sense of being at risk may also decrease over time, as given the low probability of a crash with any single incident of dangerous driving, drivers are reinforced for dangerous choices and thus ''learn'' to take risks (Fuller, 1992). While the processes suggested here have not been directly examined, there does appear to be an age-related shift, in which older adolescents who may be involved in activities that carry objective risk rate them as less risky than younger adolescents who may not be involved in them (e.g., Irwin, 1993). It has also recently been shown that adolescent cognitions about risk do appear to be responsive to their behavior, whereby they modify their thinking in order to be able to continue to participate in potentially unsafe activities (Gerrard, Gibbons, Benthin, & Hessling, 1996). Detailed longitudinal studies (see Bergman, Eklund, & Magnusson, 1989) of how attitudes toward driving risks change from early to late adolescence, may help in clarifying the nature of age-related shifts over this period.

Summary

Table 1 summarizes the psychological states outlined here, what is known about their relationship to age and gender, some possible causes that may underlie them, and interventions that could be investigated. Areas that seem particularly in need of further research are then discussed.

Future Directions

This paper argues that the risky judgments of adolescent drivers fall into three categories. Although each of these categories have received (varying amounts of) attention in the literature, there has been no systematic analysis of the relative contribution of each type of problematic judgment to young drivers' crashes. A starting point for an investigation of this type may be in-depth analysis of crash incidents or near-misses experienced by young drivers (see Rothe, 1987a, or Farrow, 1987, for possible methodologies).

Systematic study of gender differences in the type of judgments made is also warranted. While certain trends can be discerned from the literature, many studies have not included young women, and recent studies that suggest increased participation of women in risky driving (e.g., Finken et al., 1998; Shapiro et al., 1998) indicate that it is important to revisit previous findings.

Young men appear to have an exaggerated tendency to underestimate the level of personal crash risk they face, a finding that is not adequately explained by general concepts often applied to this age group, such as egocentrism and unsophisticated decision making skills. Further study of how the social context, and in particular their observations of peers' driving, may

TABLE 1
The Psychological ''Risk States'' of Adolescent Drivers: Causes and Interventions

Reduced risk perception (*Description:* Actual risk high, perceived risk low)
Underestimation of risk in particular driving scenarios
Relationship to age: Evidence suggests accentuated in adolescence.
Relationship to gender: Evidence suggests accentuated in young men.
Possible causes: General adolescent invulnerability (mixed evidence), ''rationalization'' of risk-seeking behavior (needs investigation), increasing experience in risky situations in which risk is accepted as a cost (needs investigation).
Interventions: Driver judgement training, media campaigns on specific hazards.
Underestimation of crash-risk relative to peers
Relationship to age: Evidence suggests accentuated in adolescence.
Relationship to gender: Most studies have been on young men. Prevalence in young women needs investigation.
Possible causes: General adolescent invulnerability (mixed evidence), salience of peers risky driving (needs investigation).
Interventions: Reduced media emphasis on the ''reskless young driver,'' more emphasis on positive role models.
Temporary reduction in risk monitoring
Relationship to age: Ambiguous. May drive in more distracting conditions, may be more prone to distraction (needs further investigation).
Relationship to gender: Needs investigation.
Possible causes: External distractions, e.g., passengers, loud music. Internal conditions, e.g., intense emotion, alcohol.
Interventions: Minimize young people's exposure to distracters, e.g., restrictions on carrying passengers and alcohol consumption. Education about the effects of distracting conditions.
Acceptance of risk as a cost (*Description:* Actual risk high, perceived risk high, risk valued negatively)
Relationship to age: Probably exists in all age groups, but triggered by different scenarios.
Relationship to gender: Possibly accentuated in young women, needs further investigation.
Possible causes: Adult expectations, peer expectations, limited alternatives to driving in risky conditions (needs investigation in different local contexts).
Interventions: Parent contracts, peer resistance skills training, improved access to safe transport.
Risk seeking (*Description:* Actual risk high, perceived risk high, risk valued positively)
Relationship to age: Evidence suggests accentuated in adolescence.
Relationship to gender: Evidence suggests accentuated in young men.
Possible causes: Some risk seeking is adaptive in adolescence—possible ''overgeneralization?''; hormonal characteristics of young men, gender identity issues for young men, extended adolescence, lack of social controls, peer group reinforcement, alcohol.
Interventions: Social shift in association of driving with adulthood and masculinity. Alternative venues for the display of driving skill (needs investigation). Continued/increased sanctions for drinking and driving.

interact with cognitive biases to lead to reduced perception of driving risks is indicated.

The role of intense emotion in leading to poor judgments in this age group needs investigation. In particular it is important to investigate if young drivers are more susceptible to emotional driving than older drivers and to describe the scenarios in which this type of driving leads to reduced risk monitoring or increased risk seeking.

While it is clear that all drivers experience utility in dangerous maneuvers at times, such as speeding in order to arrive at a destination on time, the reasons that adolescents accept risk in order to achieve other goals, and in particular the social pressures that underlie this, need to be further uncovered. It is likely that many of these pressures will differ across settings, with the physical structure of urban and rural environments, the enforcement of traffic laws, social norms, and parental expectations all playing a vital role.

There is extensive research outlining why adolescents may be more attracted by risk and less subject to pressures that inhibit risk seeking than adults. In particular, the processes by which social environment factors, such as risky driving portrayals in the media (Atkin, 1989) and discourse among family and friends, help create associations between driving and masculinity merit close study. In-depth interviews may also be useful to explore the kinds of feelings and cognitions that underlie risk seeking and the extent to which it fits the ''edgework'' model put forward by Lyng (1990).

Finally, prospective, longitudinal studies are needed that identify the developmental pathways which may predispose individual adolescents to each of the risk states (see Bergman, Eklund, & Magnusson, 1989, for a discussion of possible methods). Such studies could also help clarify the way in which the risk states interact and shift throughout the teenage years and into early adulthood.

Understanding the judgments of adolescent drivers is vital in the planning of effective interventions. It is hoped that the overview provided in this paper will help in the planning of further research and systematic interventions that target the various attitudes and social contexts that currently appear to make adolescents prone to problematic judgments. Continued investigation of this area is crucial if the unacceptably high road injury rate of this age group is to be lowered.

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Received March 17, 1999; revised June 15, 1999